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Research Document 2004/088 | **Document de recherche 2004/088**

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Sentinel Surveys 1995-2004: Catch per Unit Effort in NAFO Subdivision 3Ps

Relevés sentinelles 1995-2004 – Captures par unité d'effort dans la sous-division 3Ps de l'OPANO

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ISSN 1480-4883 (Printed/Imprimé)
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105-06112/

ABSTRACT

Sentinel enterprises continued to collect catch rate and biological information on inshore 3Ps cod resources in 2004. Gillnet catch rates (weekly average number of fish per net) in 2004 remained low compared to 1996-1998 catch rates. Catch rates in small mesh gillnet remained low. Length frequencies of cod caught in small mesh gillnet showed fewer fish at the two size modes (36-44 cm and 52-56 cm) that this gear catches since 2000. Linetrawl catch rates (weekly average number of fish per 1000 hooks) have increased from the series low in 2000 and showed an increase in the number of fish at the 44-54 cm size range from 2002 to 2004.

RÉSUMÉ

En 2004, les entreprises de pêche sentinelle ont continué de recueillir des données biologiques et des données de taux de capture sur la morue côtière de 3Ps. En 2004, les taux de capture au filet maillant (nombre moyen hebdomadaire de prises par filet) sont restés faibles par rapport à ceux de 1996 à 1998. Les taux de capture dans les filets à petit maillage sont restés faibles; les fréquences des longueurs des morues capturées dans ces filets montrent que moins de poissons des deux modes de taille (36-44 cm et 52-56 cm) ont été capturés depuis l'année 2000. Les taux de capture à la ligne traînante (nombre moyen de prises par 1000 hameçons) ont augmenté par rapport au minimum de 2000, et le nombre de poissons de taille allant de 44 à 54 cm a augmenté de 2002 à 2004.

INTRODUCTION

Sentinel survey projects were formally announced by the Minister of Fisheries and Oceans in October 1994. The surveys in the DFO Newfoundland Region are an extension of the index fishermen's project from the Northern Cod Science Project with modifications to allow for science activities achievable only under a fishing moratorium. Sentinel data collection has continued during the index fishery of 1998 and commercial fisheries in 1999-2004.

The sentinel survey has the following objectives:

1. To develop a catch rate series for use in resource assessments.
2. To incorporate the knowledge of inshore fishers in to the resource assessment process.
3. To describe the temporal-spatial distribution of cod in the inshore area over a number of years through, for example, the use of catch rate information, tagging studies, by-catch information and fishers' observations.
4. To gather length frequencies, sex and maturity data and sample ages for use in resource assessment.
5. To establish a long-term physical oceanographic and environmental monitoring program of the inshore areas.
6. To provide a source of biological material for other researchers. For example, tissue for genetic, physiological and toxicological analyses, cod stomachs for food and feeding studies and by-catch information.

Participants

The primary collectors of data in the sentinel survey are inshore fishers. Through consultation with inshore fishers and fisheries organizations, traditional inshore fishing grounds have been identified and mapped, resulting in 16 locations in NAFO Subdivision 3Ps.

Fishers from communities within the boundaries of the identified coastal areas and who met eligibility criteria were invited to apply to participate in the survey. Where more than one application was received from an area, the project partner conducted a draw or lottery to select the participant. While there was considerable interest in the project in most areas, there were many sites from which only one application was received and others where additional canvassing was required to enlist participants. Selected participants were required to complete a six-week course designed by the Marine Institute of Memorial University in consultation with DFO. Topics covered included scientific sampling methods and equipment, computer use, resource assessment basics and presentation skills.

In order to minimize inter-annual enterprise effects on data collection, participants are expected to remain with the survey over a number of years. It is also expected that most of the sampling activities will continue once commercial fishing operations resume and the sentinel participants will form a core of index fishers.

Sites

Since 1995, participants from 19 communities have taken part in the Sentinel program. The specific location of each site was chosen after consultation between DFO scientists, fishermen and the Fish, Food and Allied Workers Union (FFAW). Site selection was based on the need to survey throughout inshore areas and targeted historical fishing areas and historical gear use patterns. Several sites no longer participate in the survey and in 2003 fourteen enterprises continued to collect information. In 2004, thirteen sites continued with the program.

Sampling Strategy

The communities of the enterprises involved in the Sentinel survey, as well as the number of sets completed each year and the total number of weeks allocated, are given in Table 1. Survey activity was lowest in 2003, when several sites were cut from the program due to funding pressures and the number of weeks allocated for the survey was also reduced. The timing of sampling was determined after discussions with fishers but was targeted for seasonally appropriate times based on historical fishing patterns. There was minimal disruption of these time frames in 1999 through 2004 due to the opening of the commercial fishery.

There were no traps involved in Sentinel sampling in 3Ps in 1999, or 2002-2004; two traps were used in 2000 and three in 2001. Participants used either baited trawl lines or gillnets for the remaining weeks of the survey. Non-trap sites fished either baited trawls or gillnets for the full survey. While traps are in the water continuously, they were hauled three days per week. Hook and line and gillnet crews fished up to three days per week. Fishing days in the week were selected at the discretion of the crew and depend primarily on weather conditions.

When a cod trap was hauled, the crew estimated how much fish by weight had been caught, removed a random sample for biological sampling and released the remaining catch. Meshed and/or dead, floating fish were retained and brought ashore. Fishers were instructed to release as much live fish as possible.

Hook and line crews fished two tubs of baited linetrawl. Each tub consisted of approximately 500 hooks for a total of 1000 hooks per fishing day. Gillnet crews fished a maximum of six fifty fathom 5 ½ inch monofilament gillnets. Nets were rigged 2-3 to a fleet and up to three fleets were fished per fishing day. Selected sites fished one 3¼ inch monofilament gillnet tied to one 5 ½" gillnet one day per week. All fish caught in gillnets and on hooks were landed and measured. If catches exceeded 500 kg per week, the numbers of nets in a fleet were cut back. However, some consideration was given to bottom topography and net performance when reducing the number of nets in a fleet. Similarly, the number of hooks per tub was reduced if landings exceeded 500 kg per week. Other measures were considered if fish are particularly abundant in an area and catches appear to be excessive even with the minimal amounts of gear possible.

Prior to the start of sampling in 1995, a fixed (control) location on the fishing grounds was established for each site and will remain fixed for the duration of the project. Each fishing day, up to half of the gear was set at the control site. When competition with commercial fishers prevented setting at the control site, gear was set as close to the control grounds as possible. The remainder of the gear (experimental) was set at one or two other locations on the fishing grounds at the discretion of the crew. The location of each fishing set was plotted on a nautical chart. The time of the set and the soak time for the gear were recorded. Other environmental observations were

recorded, including wind direction and speed, percent cloud cover, tide conditions, presence of invertebrates (bait) and other fish species in the area, marine mammals, sea birds and any other variables which might have influenced fishing behavior. Selected sites were equipped with a CTD (measuring temperature and salinity at depth). At these locations, casts were conducted in the vicinity of fishing sets each fishing day. CTD locations were fished for subsequent years if possible.

When the gear was retrieved, catches from the control and experimental gear were kept separate and sampled on shore. All fish from gillnet, handline and linetrawl, and a sample of the catch from traps, were measured for length and sex. Otoliths were sampled on a length-stratified basis and stored in manila envelopes with relevant information recorded on the outside. Every other week, selected sites collected a sample of up to 100 frozen fish. These were transported to St. John's for detailed biological sampling. All information was recorded on forms similar to those used by the Port Sampling Section and on DFO Research Vessels

Other biological samples were collected as needed.

Data Presentation

The data are summarized for all of 3Ps and presented by gear type. Summaries for each enterprise follow, in general, organized from east to west. This paper presents data for gillnet (5 ½" and 3 ¼" mesh) and linetrawl. The length frequency plots depict the number of fish at length scaled by total amount of gear fished so that changes in length frequency distribution may be compared across years. Lengths, in 1cm intervals, are from both control and experimental gear, and for gillnet and linetrawl represent every fish measured, as the total catch is measured. Length frequency summaries for NAFO division are shown as an average of the relative length frequencies for each fisher in the division. The second figure on each summary sheet gives catch details broken down by year, including total number of sets (Nhauls), number of sets in which no fish were caught (Nzero), and number of fish caught (Nmeas). The CPUE figures show control and experimental catches combined, in number of fish per net or per 1000 hooks by week and are constructed by calculating a daily catch rate for each set and averaging all the CPUEs for all sets in a given week.

RESULTS

Data summarizing Sentinel survey activity in 3Ps for 1995 through 2004 are presented in figures 1-90. Fourteen inshore fishing enterprises representing communities from St. Bride's to Burgeo participated in the 3Ps Sentinel Survey for 2003, while one site was discontinued in 2004. In 2003 there was a significant reduction in sentinel effort from previous years. A total of 247 sets of 5 ½" gillnet and 47 sets of 3 ¼" gillnet resulted in total measurements of 2 335 fish. Two hundred and fourteen sets of linetrawl resulted in 1 161 measurements for 2003. Data collection is ongoing in 2004.

Figures 1-4 show all set locations and catch per unit effort in scaled symbols that were surveyed up until October in 2004 and those surveyed in 1998 (for comparison). Linetrawl and gillnet are shown separately. The location of the control sites (fixed stations) were generally consistent from year to year but shifts in location may have resulted due to weather or tide conditions or competition for sites by commercial activity.

Figures 5 and 6 show the overall average CPUE (catch per unit of effort) for all of 3Ps and by community for 5 ½" gillnet and linetrawl. Gillnet CPUE is considerably lower in recent years in all

communities. Linetrawl also declined from 1996-2000 but in 2001 to 2004 overall mean CPUE has increased. This increase is due largely to good catches of small fish in Burgeo and Ramea and some special sets on Burgeo Bank. As well, in 2002, the participant in Burgeo could not fish the required weeks in the first quarter due to mechanical failure. These weeks fished in previous years had lower catch rates and moderated the yearly mean CPUE.

Figures 7 and 8 give average length frequencies scaled by amount of activity. Gillnet catches in 3Ps, compared to other NAFO areas (Fig. 7), were highest from 1995-1997. Since then, 3L has had higher mean catch rates. All areas have shown lower catch rates since 1998. For linetrawl (Fig. 8) catches declined in 3Ps from 1995-2000, but increased since then.

Figure 9 shows mean relative length frequencies from 1995-2004 for the three main gears used for Sentinel. Five and a half inch gillnet catches declined steadily from 1996-2000 and have remained low since then. Three and a quarter inch gillnet also declined during this time with changes in which mode of fish size was dominant in various years. The mode of larger fish (second peak in the frequency) was highest in 1996 and much less prominent from 2000-2004.

The summary data for 3Ps gillnet (5 ½"), in Figures 19-39, give an indication of catch rate change since inception of the Sentinel Survey in 1995. Gillnets show the narrowest range of selectivity of Sentinel Survey gears, targeting fish in the 50cm to 80cm range. In general, catch rates from 5 ½" gillnets were lowest from 2001 to 2004, considerably lower than the best catch rates seen in 1996. Most sites in 2004 had similar catch rates to those of 2003.

Small mesh gillnets (3 ¼") were used in 3Ps since 1995 in order to get information on smaller size ranges of fish. Figures 40-60 summarize the results. One 3 ¼" gillnet (35 fathoms) was fished in combination with one 5 ½" Gillnet (50 fathoms) primarily on experimental sites. A strong bimodal peak in length frequency distribution results from this mesh size as the gear selects two size ranges of fish. The first and strongest peak, in most cases, is between 35cm and 47cm. Fish in this size range are meshed while the larger fish (52cm to 65cm) are caught by the lips and generally entangle as they twist around.

Overall mean catch rates in the small mesh gear were lower in 2004 than those seen in 1996 through 1999.

Figures 61-90 summarize the data from the linetrawl portion of the 3Ps Sentinel Survey. Linetrawl shows a much wider selectivity curve than gillnet and catches mainly fish between 29cm and 83cm.

Linetrawl catch per unit effort declined consistently from 1995 through 2000. Since 2000, catches were higher and composed mainly of smaller fish. For 2004, only two sites have completed linetrawl sets as other sites fish this gear later in the year.

Table 1. Number of Sentinel sets (all gears) by community since 1995 and the weeks allocated for each year.

Community	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
St. Bride's	163	88	74	80	2	57	63	80	59	50
Fox Hr	146	88	72	72	36	48	60	60	48	30
Little Hr East	163	50	57	48	10	46	67			
Fairhaven								73		
Arnold's Cove	153	63	69	27	8	42				
North Hr	118	74	70	50	20	54	55	43	46	10
Monkstown	148	69	72	72	36	51	60	60		
Placentia		41								
Little Paradise	74	55	51	55	36	49	69	64	42	42
Red Hr	51	46	41	47	21	32	36	61	22	31
Lawn		57	69	71	36	64	78	80	36	72
Lord's Cove	61	55	68	66	36	48	70	84	47	70
Grand Bank							60	60	38	24
Rencontre East	180	96	71	74	35	54	72	60	20	
Hr Breton	158	39	27	28	32	29	31	54	34	3
Seal Cove	204	71	44	42	33	54	46	48	9	
Francois	181	66	74	69	18	30	36	30	25	
Ramea	206	46	96	60	38	88	92	88	46	32
Burgeo		46	60	62	26	32	64	46	36	16
Number of weeks allocated	30*	12	12	12	6	8	10	10	6	9

* Includes 15 week pilot project

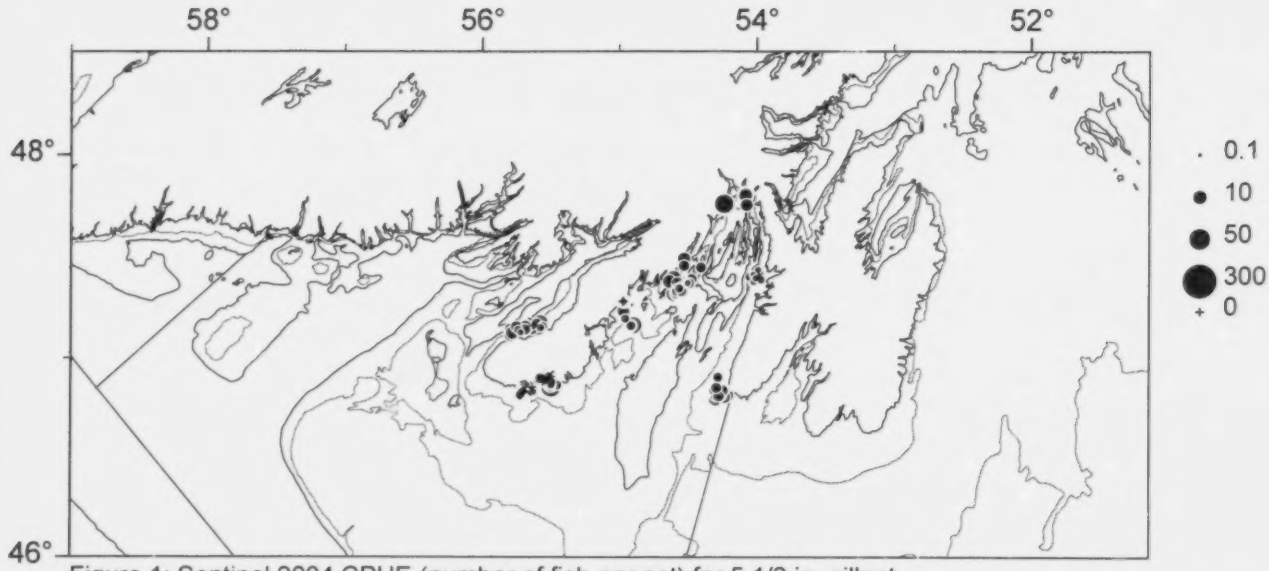


Figure 1: Sentinel 2004 CPUE (number of fish per net) for 5 1/2 in. gillnet.

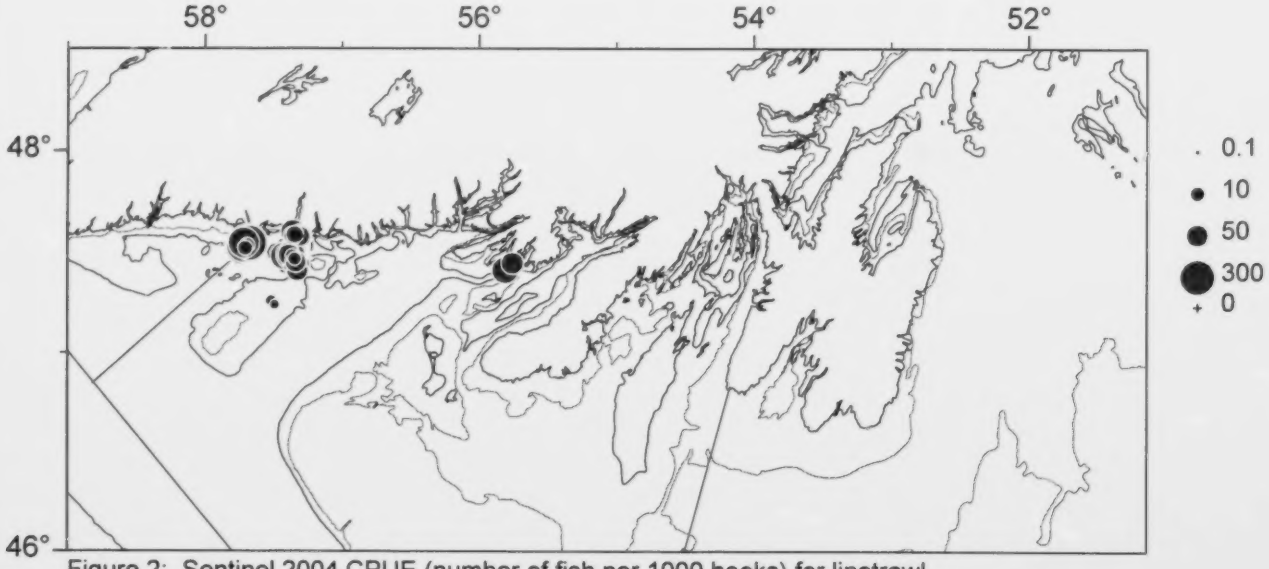


Figure 2: Sentinel 2004 CPUE (number of fish per 1000 hooks) for linetrawl.

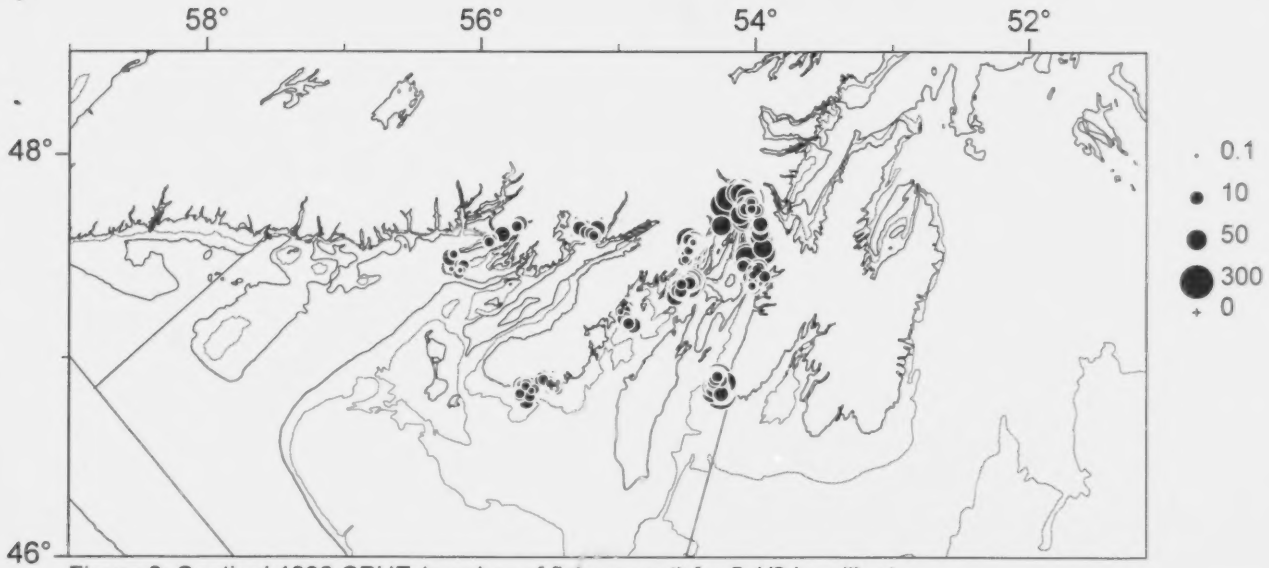


Figure 3: Sentinel 1998 CPUE (number of fish per net) for 5 1/2 in. gillnet.

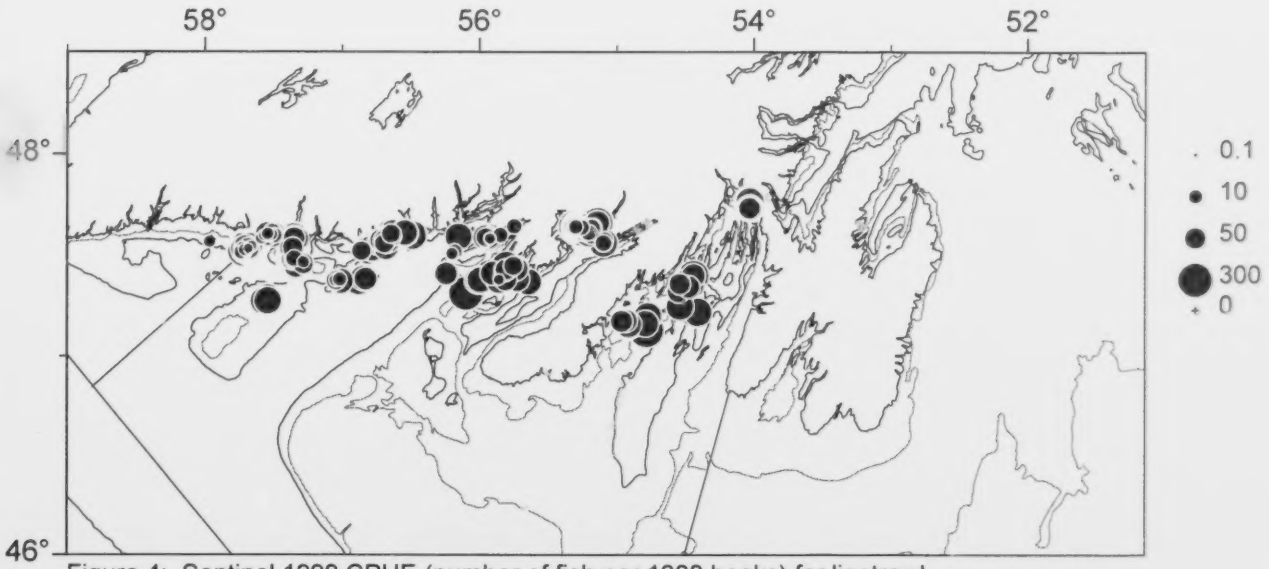


Figure 4: Sentinel 1998 CPUE (number of fish per 1000 hooks) for linetrawl.

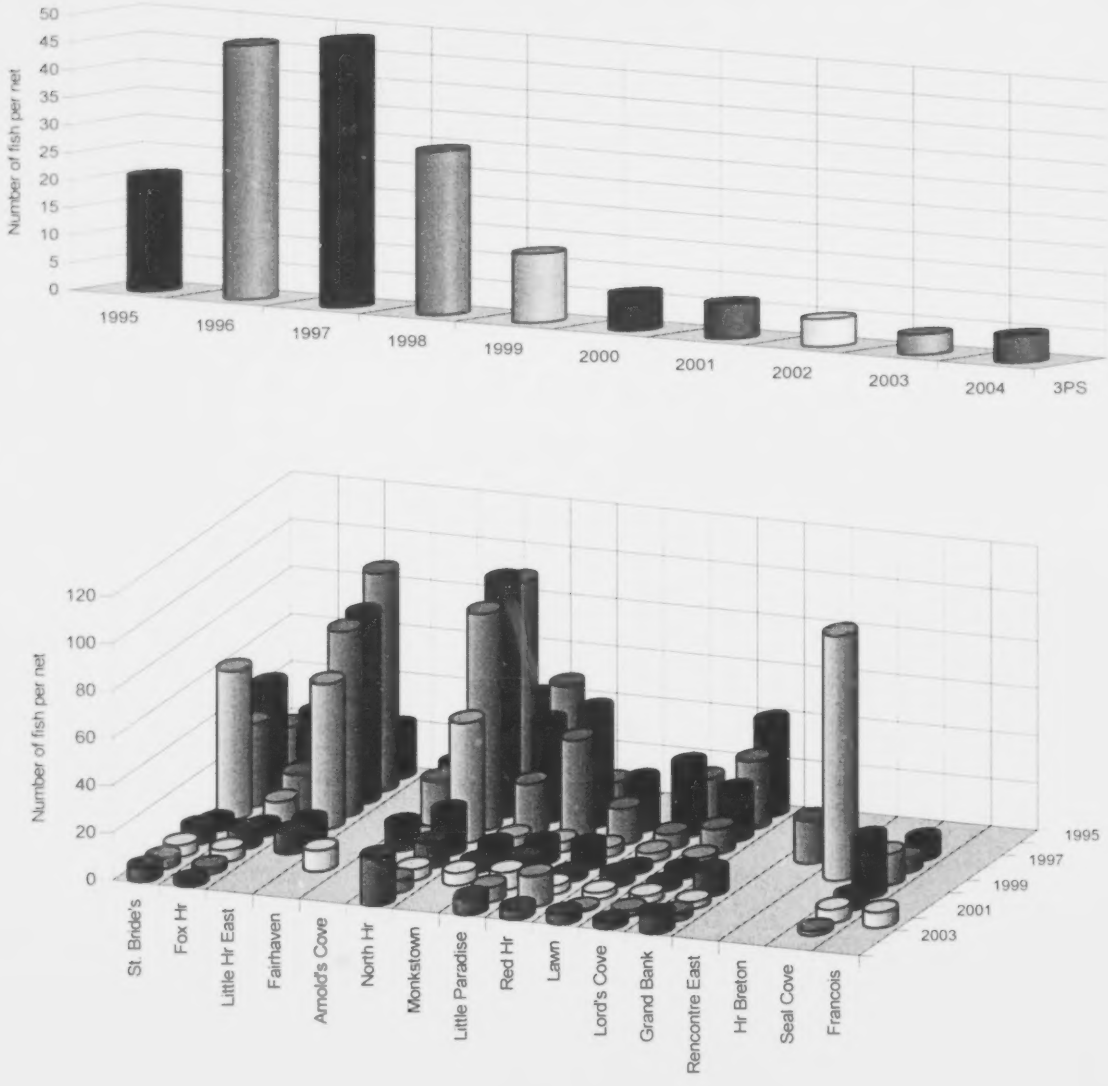


Figure 5. Overall mean CPUE (top panel) and mean CPUE by community (lower panel) for 5 1/2" gillnet 1995-2004.

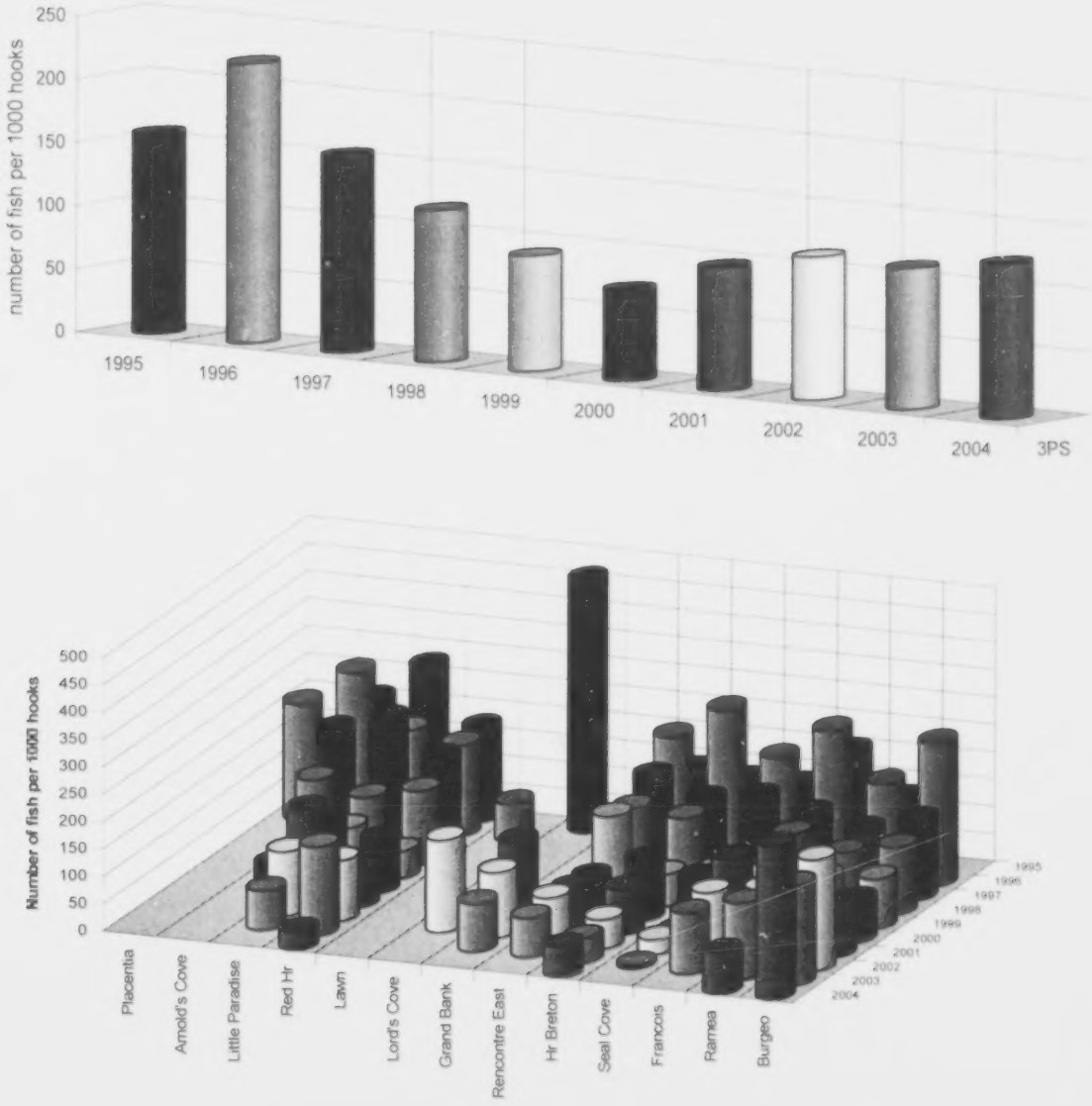


Figure 6. Overall mean CPUE (top panel) and mean CPUE by community (lower panel) for linetrawl 1995-2004

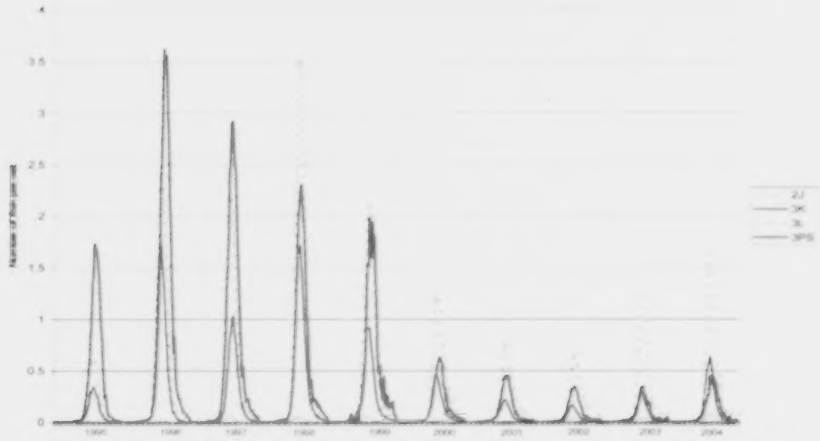


Figure 7. Mean relative length frequencies by division 1995-2004 for 5 1/2" gillnet. Frequencies range from 20cm-90cm for each year.

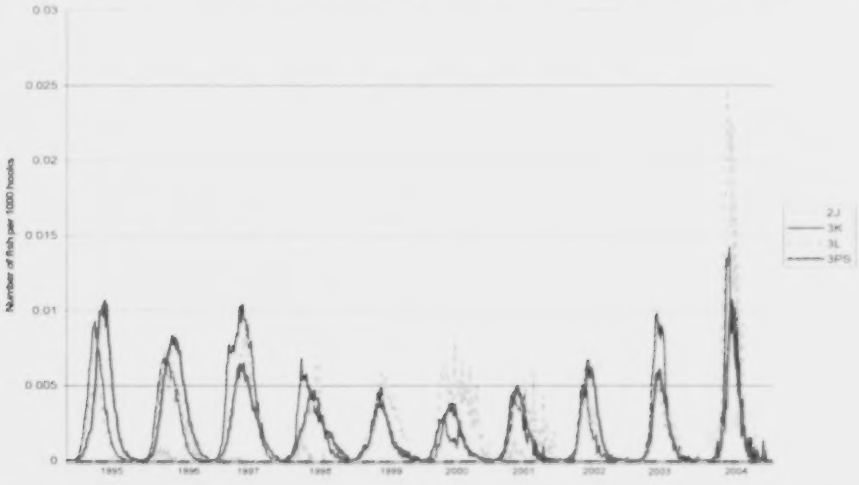


Figure 8. Mean relative length frequencies by division 1995-2004 for linetrawl. Frequencies range from 20cm-90cm for each year.

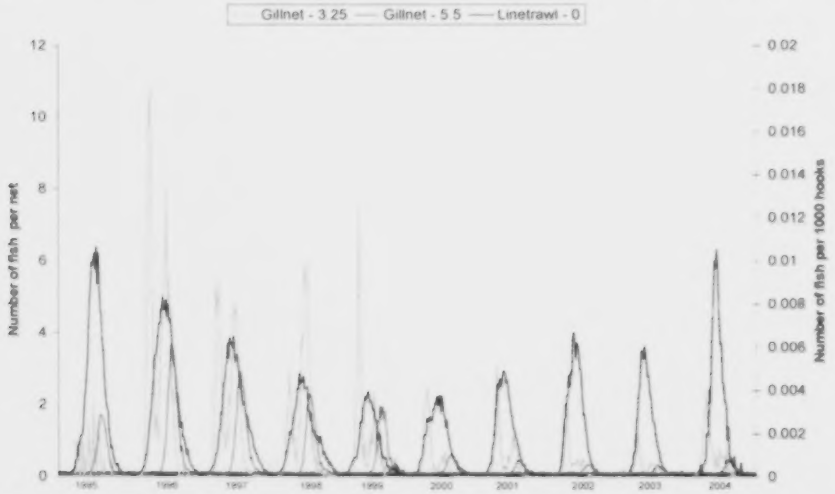


Figure 9. Mean relative length frequencies for 3Ps 1995-2004 for gillnet (5 1/2" and 3 1/4") and linetrawl.

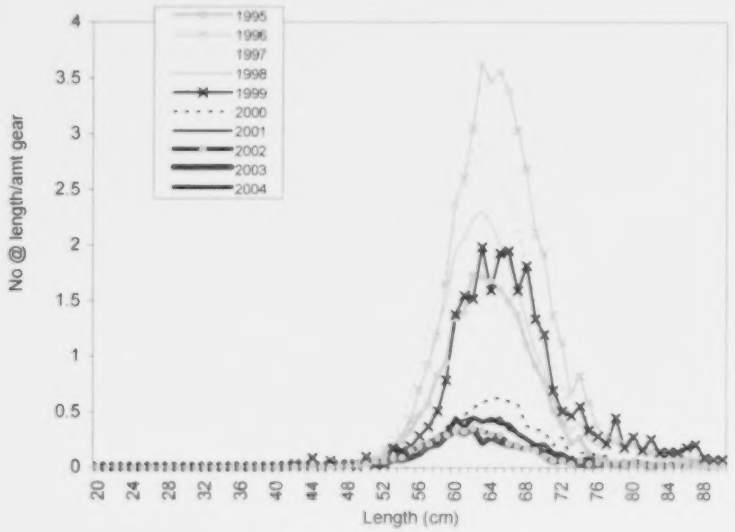
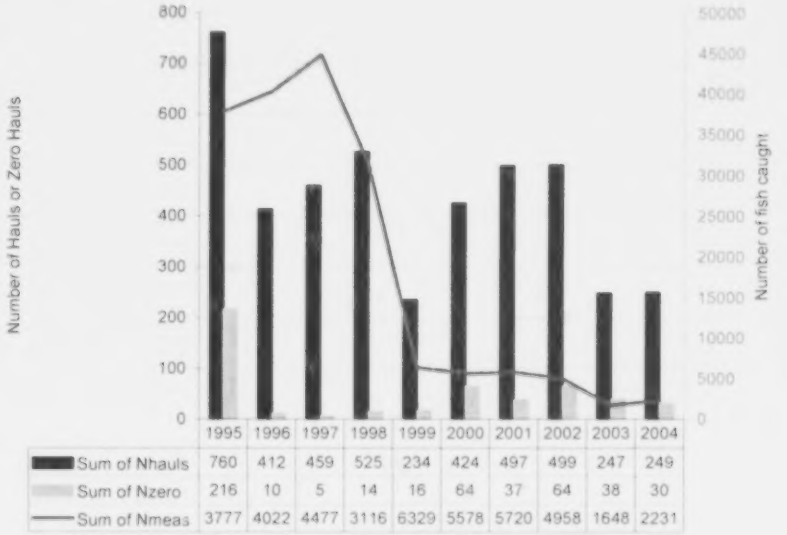


Figure 10. Relative length frequency (number at length / amount of gear) for control and experimental gears, 3Ps Gillnet 5 1/2 in.



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Sum of Nhauls	760	412	459	525	234	424	497	499	247	249
Sum of Nzero	216	10	5	14	16	64	37	64	38	30
Sum of Nmeas	3777	4022	4477	3116	6329	5578	5720	4958	1648	2231

Figure 11. Number of hauls (Nhauls), number of zero catch hauls (Nzero) and total number of fish caught (Nmeas), for control and experimental gears, 3Ps Gillnet 5 1/2 in.

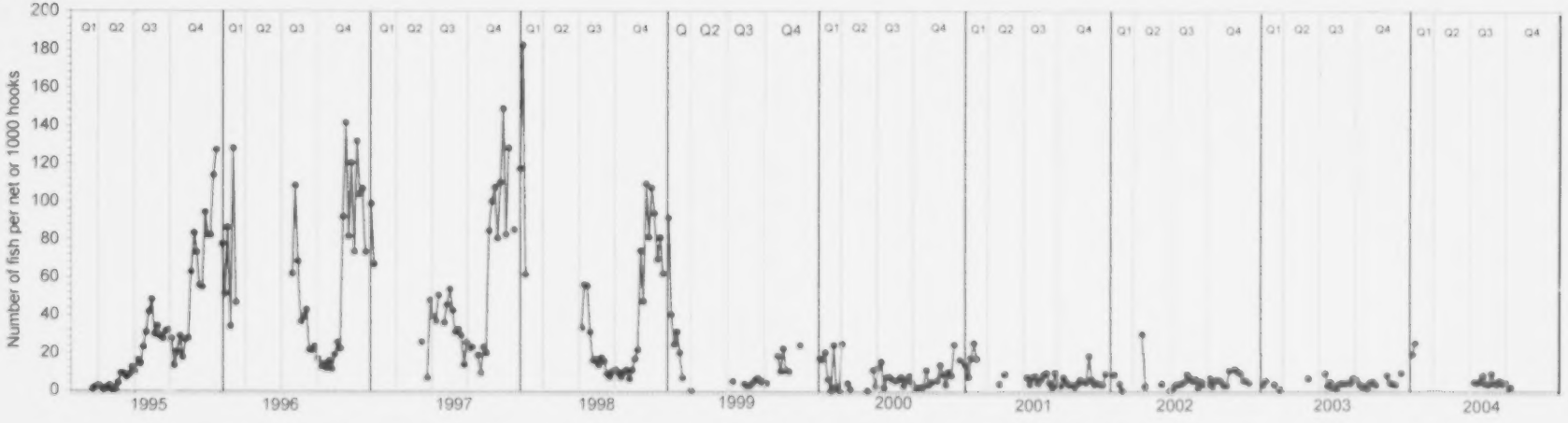


Figure 12. Catch per unit effort (in numbers of fish per net) for all sets (control and experimental) averaged for each week, 3Ps Gillnet 5 1/2 in.

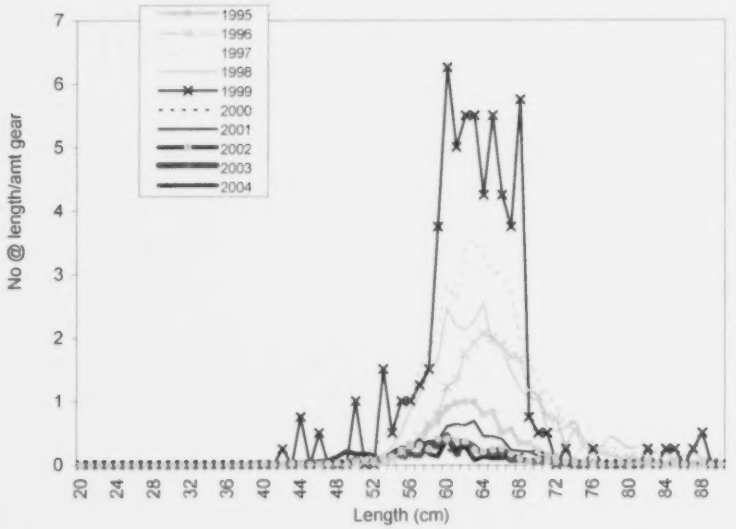
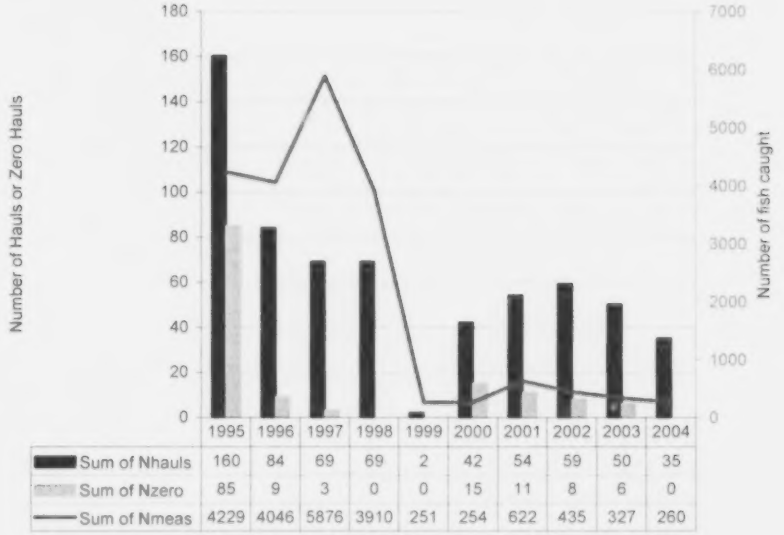


Figure 13. Relative length frequency (number at length / amount of gear) for control and experimental gears, St. Bride's Gillnet 5 1/2 in.



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Sum of Nhauls	160	84	69	69	2	42	54	59	50	35
Sum of Nzero	85	9	3	0	0	15	11	8	6	0
Sum of Nmeas	4229	4046	5876	3910	251	254	622	435	327	260

Figure 14. Number of hauls (Nhauls), number of zero catch hauls (Nzero) and total number of fish caught (Nmeas), for control and experimental gears, St. Bride's Gillnet 5 1/2 in.

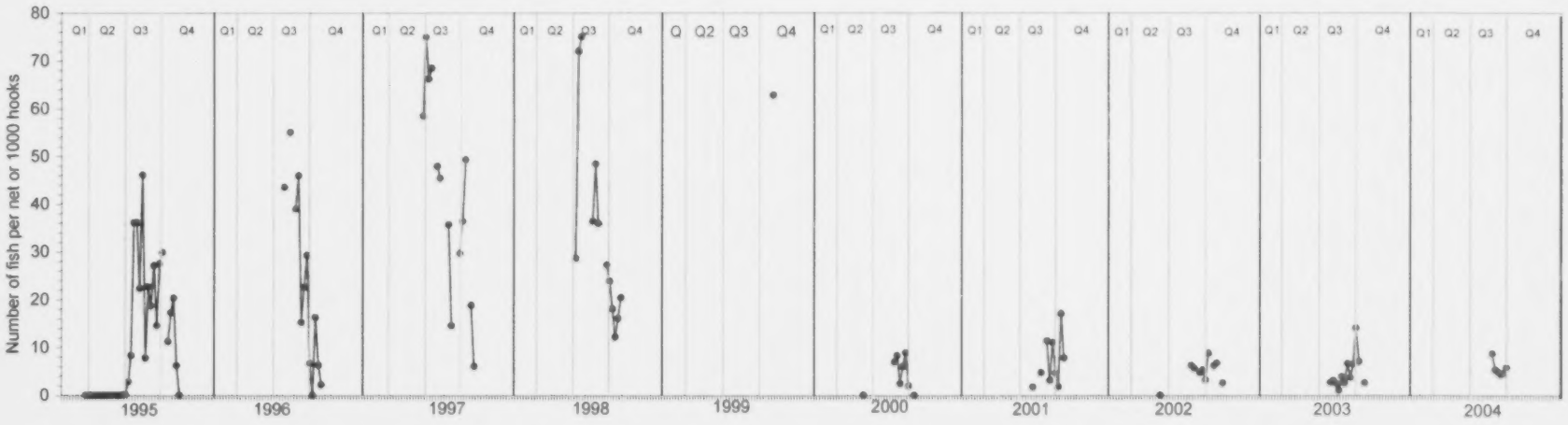


Figure 15. Catch per unit effort (in numbers of fish per net) for all sets (control and experimental) averaged for each week, St. Bride's Gillnet 5 1/2 in.

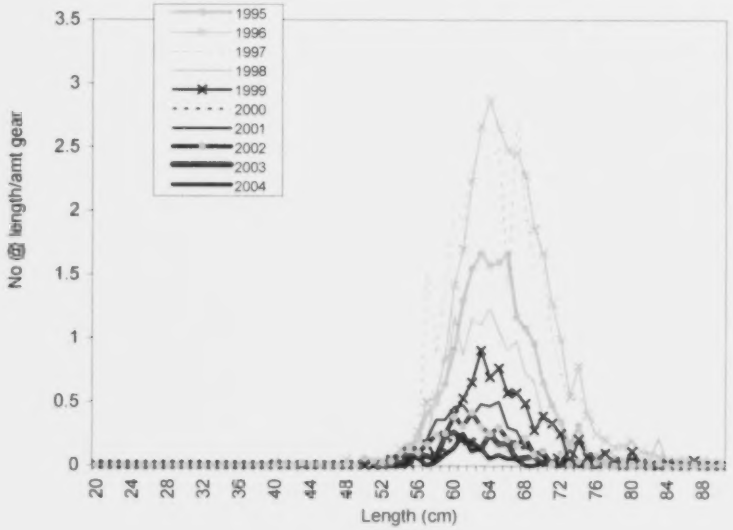
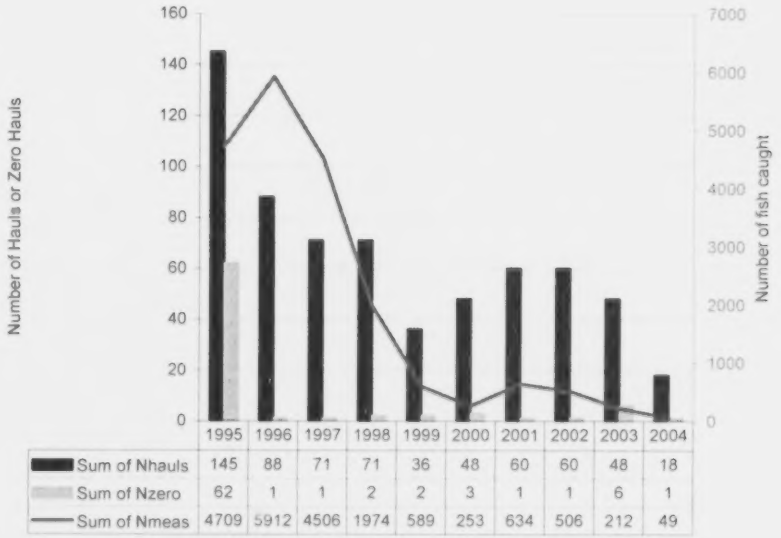


Figure 16. Relative length frequency (number at length / amount of gear) for control and experimental gears, Fox Hr Gillnet 5 1/2 in.



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Sum of Nhauls	145	88	71	71	36	48	60	60	48	18
Sum of Nzero	62	1	1	2	2	3	1	1	6	1
Sum of Nmeas	4709	5912	4506	1974	589	253	634	506	212	49

Figure 17. Number of hauls (Nhauls), number of zero catch hauls (Nzero) and total number of fish caught (Nmeas), for control and experimental gears, Fox Hr Gillnet 5 1/2 in.

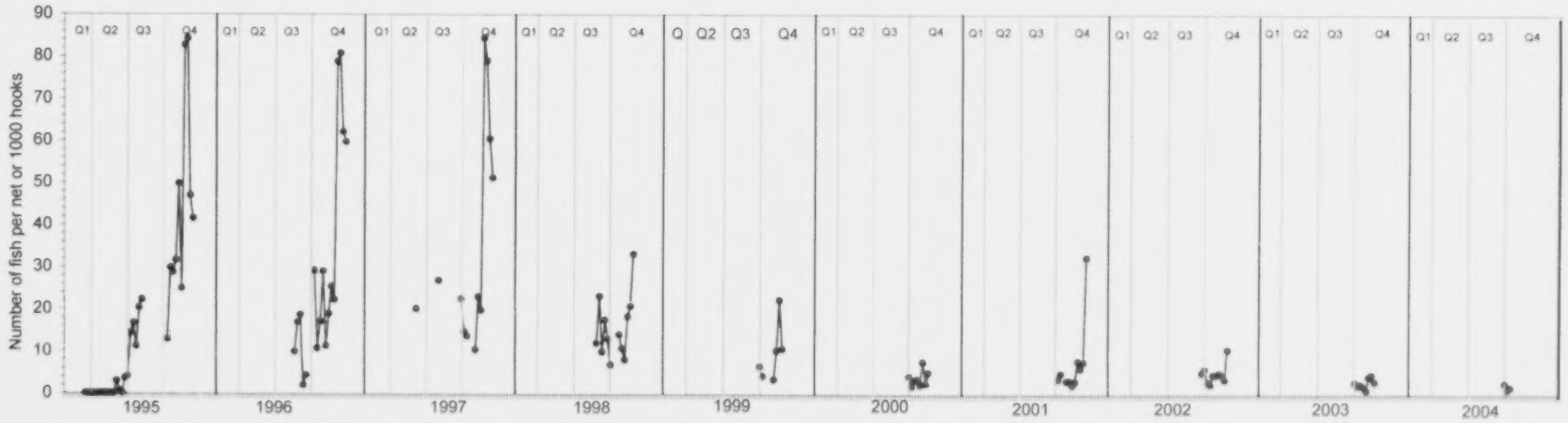


Figure 18. Catch per unit effort (in numbers of fish per net) for all sets (control and experimental) averaged for each week, Fox Hr Gillnet 5 1/2 in.

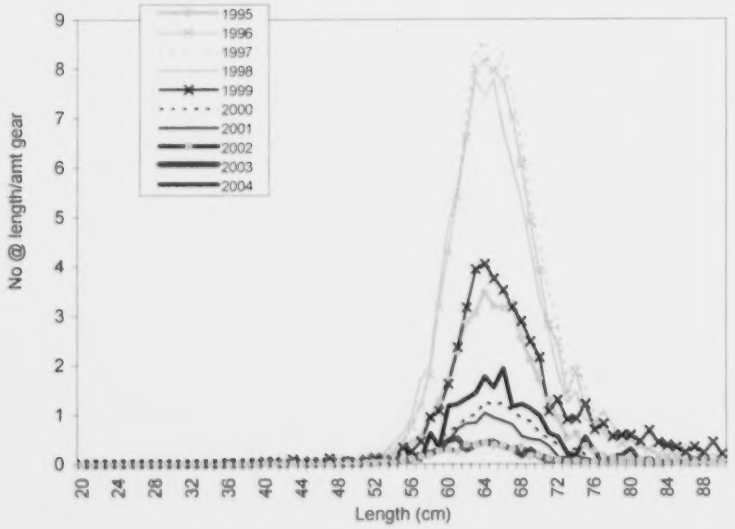
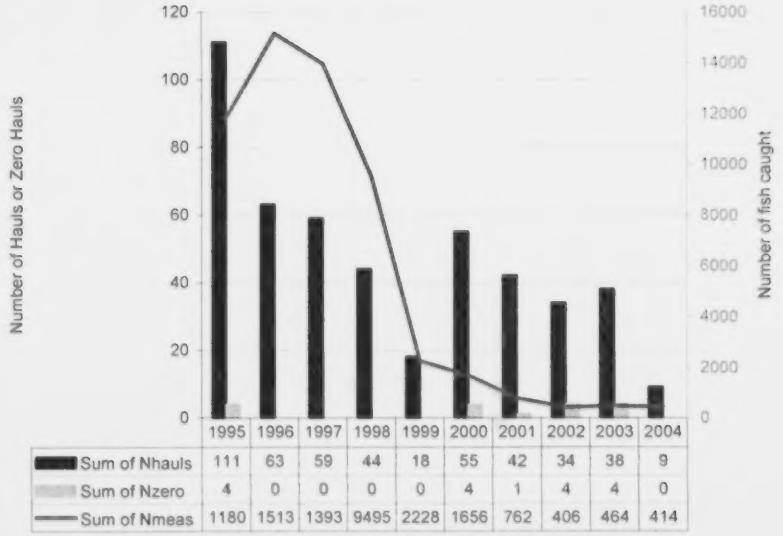


Figure 19. Relative length frequency (number at length / amount of gear) for control and experimental gears, North Hr Gillnet 5 1/2 in.



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Sum of Nhauls	111	63	59	44	18	55	42	34	38	9
Sum of Nzero	4	0	0	0	0	4	1	4	4	0
Sum of Nmeas	1180	1513	1393	9495	2228	1656	762	406	464	414

Figure 20. Number of hauls (Nhauls), number of zero catch hauls (Nzero) and total number of fish caught (Nmeas), for control and experimental gears, North Hr Gillnet 5 1/2 in.

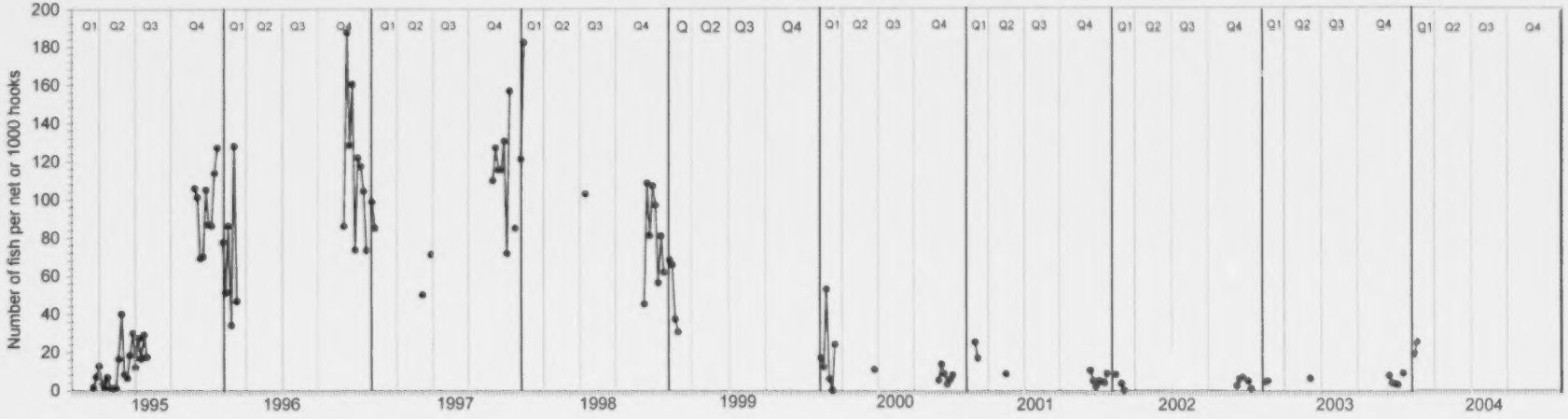


Figure 21. Catch per unit effort (in numbers of fish per net) for all sets (control and experimental) averaged for each week, North Hr Gillnet 5 1/2 in.

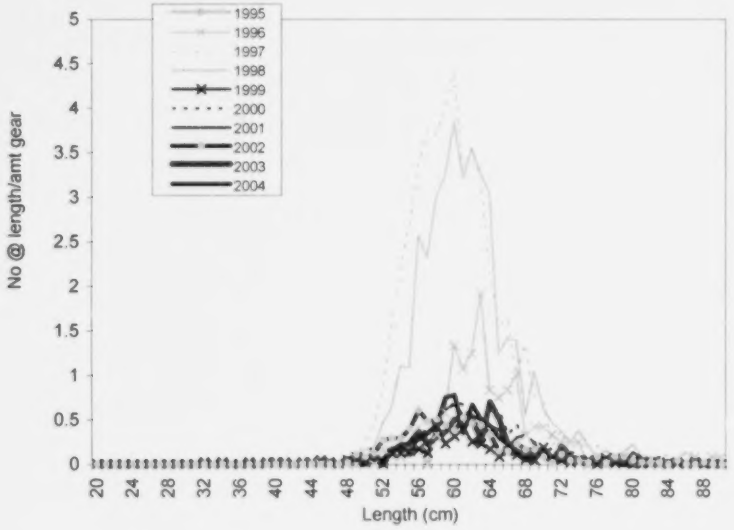
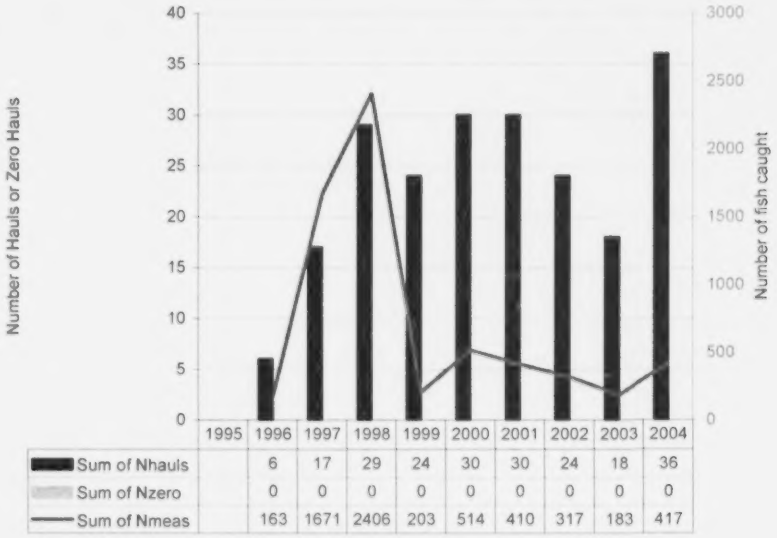


Figure 22. Relative length frequency (number at length / amount of gear) for control and experimental gears, Little Paradise Gillnet 5 1/2 in



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Sum of Nhauls		6	17	29	24	30	30	24	18	36
Sum of Nzero		0	0	0	0	0	0	0	0	0
Sum of Nmeas		163	1671	2406	203	514	410	317	183	417

Figure 23. Number of hauls (Nhauls), number of zero catch hauls (Nzero) and total number of fish caught (Nmeas), for control and experimental gears, Little Paradise Gillnet 5 1/2 in.

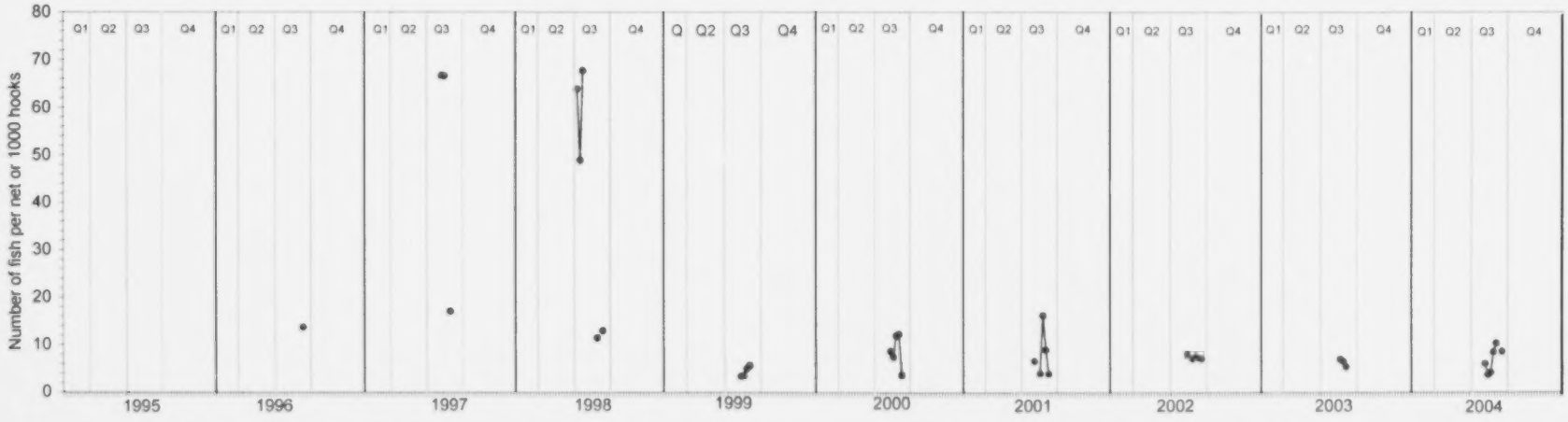


Figure 24. Catch per unit effort (in numbers of fish per net) for all sets (control and experimental) averaged for each week, Little Paradise Gillnet 5 1/2 in.

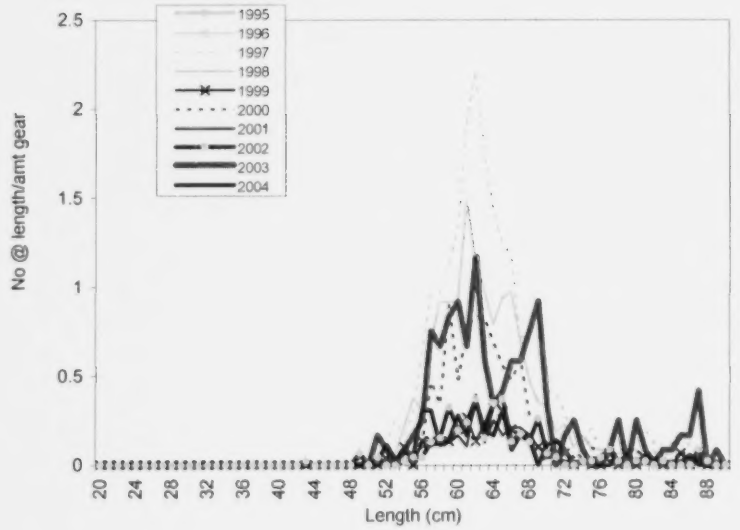
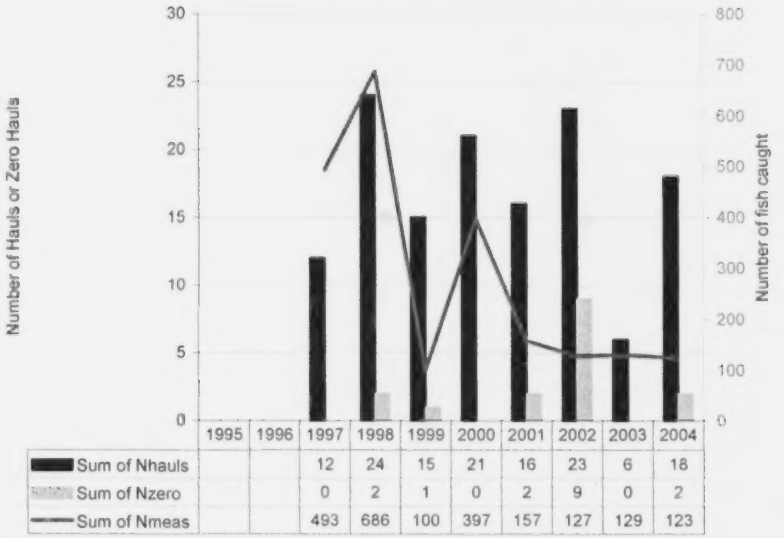


Figure 25. Relative length frequency (number at length / amount of gear) for control and experimental gears, Red Hr Gillnet 5 1/2 in.



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Sum of Nhauls			12	24	15	21	16	23	6	18
Sum of Nzero			0	2	1	0	2	9	0	2
Sum of Nmeas			493	686	100	397	157	127	129	123

Figure 26. Number of hauls (Nhauls), number of zero catch hauls (Nzero) and total number of fish caught (Nmeas), for control and experimental gears, Red Hr Gillnet 5 1/2 in.

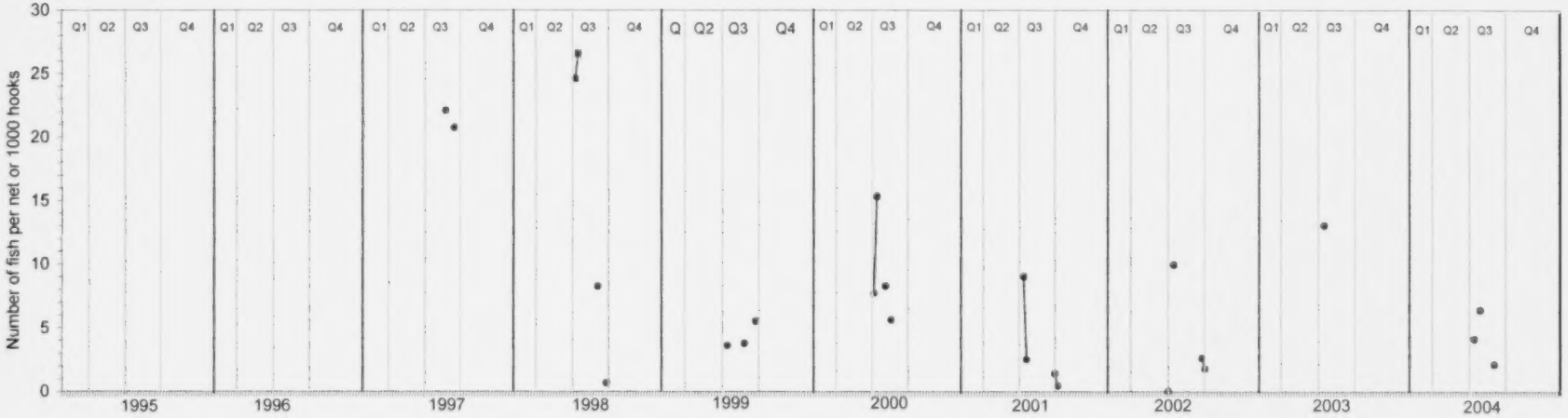


Figure 27. Catch per unit effort (in numbers of fish per net) for all sets (control and experimental) averaged for each week, Red Hr Gillnet 5 1/2 in.

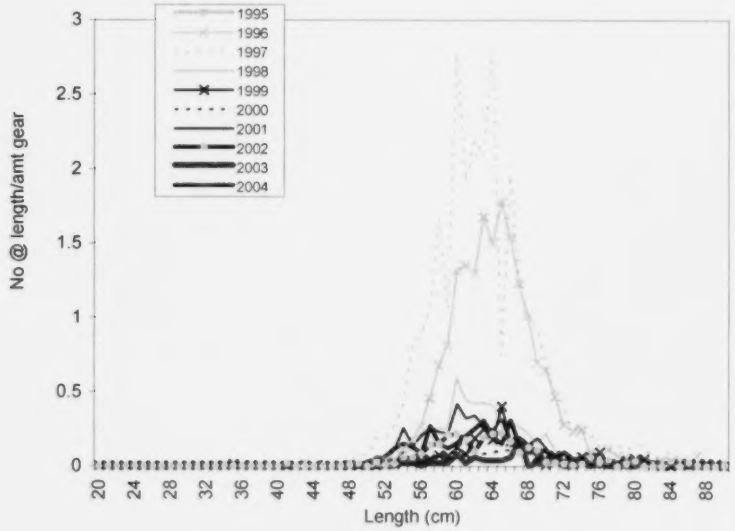
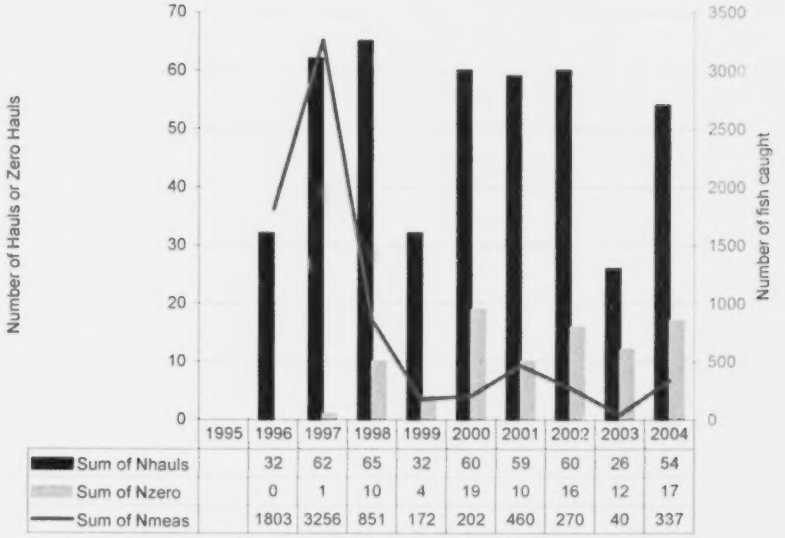


Figure 28. Relative length frequency (number at length / amount of gear) for control and experimental gears, Lawn Gillnet 5 1/2 in.



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Sum of Nhauls		32	62	65	32	60	59	60	26	54
Sum of Nzero		0	1	10	4	19	10	16	12	17
Sum of Nmeas		1803	3256	851	172	202	460	270	40	337

Figure 29. Number of hauls (Nhauls), number of zero catch hauls (Nzero) and total number of fish caught (Nmeas), for control and experimental gears, Lawn Gillnet 5 1/2 in.

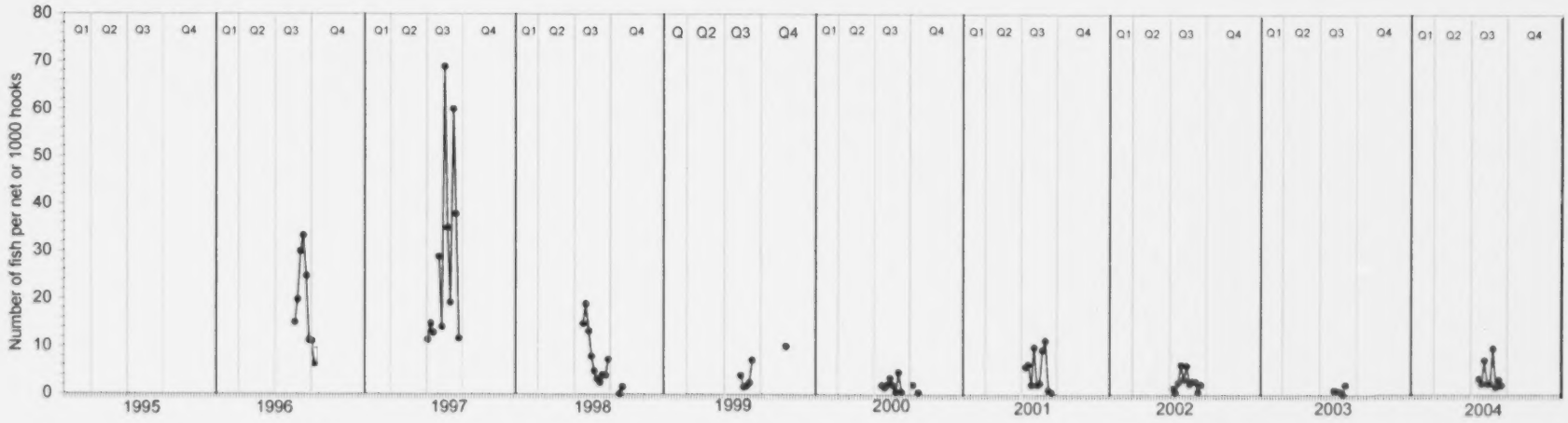


Figure 30. Catch per unit effort (in numbers of fish per net) for all sets (control and experimental) averaged for each week, Lawn Gillnet 5 1/2 in.

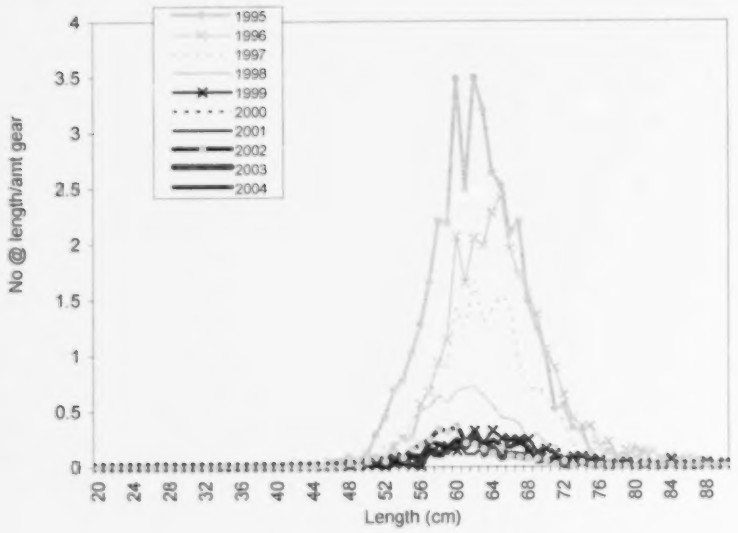
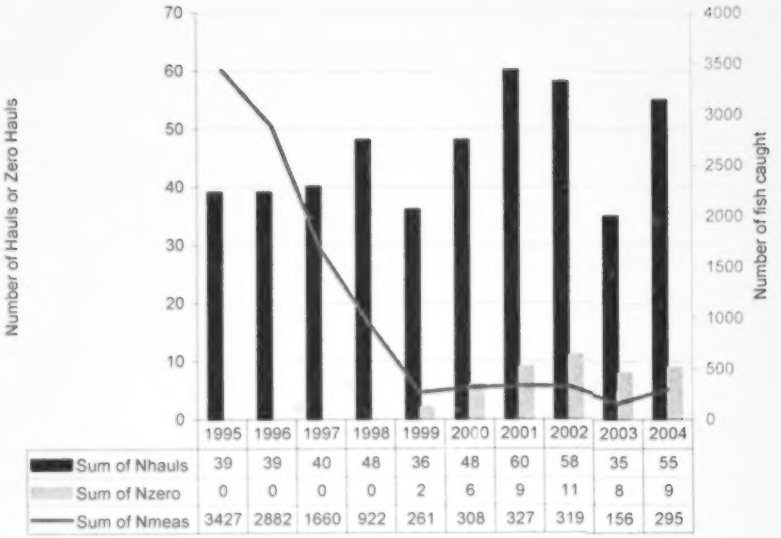


Figure 31. Relative length frequency (number at length / amount of gear) for control and experimental gears, Lord's Cove Gillnet 5 1/2 in.



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Sum of Nhauls	39	39	40	48	36	48	60	58	35	55
Sum of Nzero	0	0	0	0	2	6	9	11	8	9
Sum of Nmeas	3427	2882	1660	922	261	308	327	319	156	295

Figure 32. Number of hauls (Nhauls), number of zero catch hauls (Nzero) and total number of fish caught (Nmeas), for control and experimental gears, Lord's Cove Gillnet 5 1/2 in.

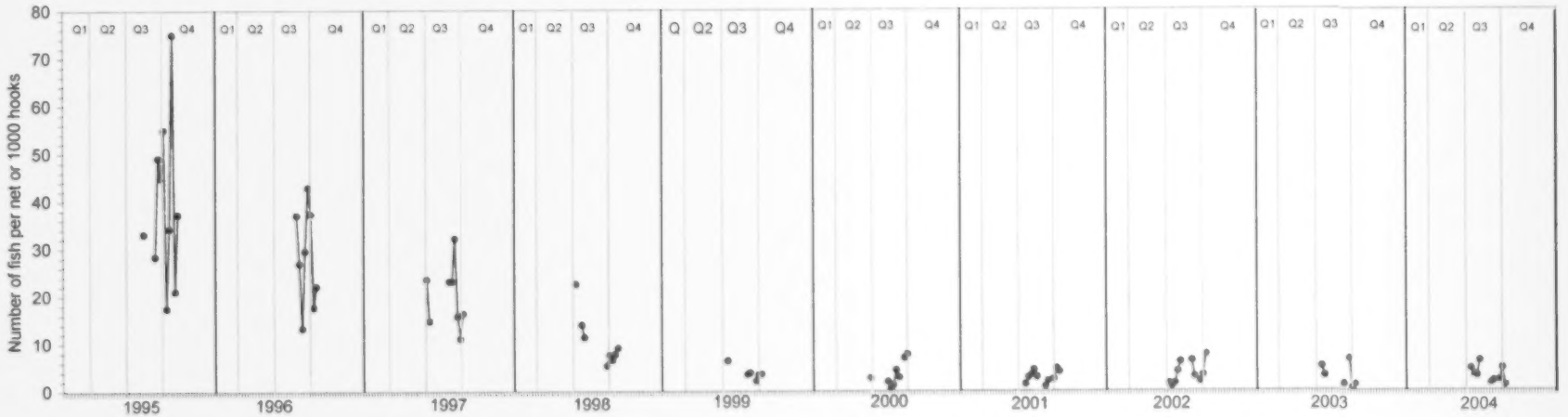


Figure 33. Catch per unit effort (in numbers of fish per net) for all sets (control and experimental) averaged for each week, Lord's Cove Gillnet 5 1/2 in.

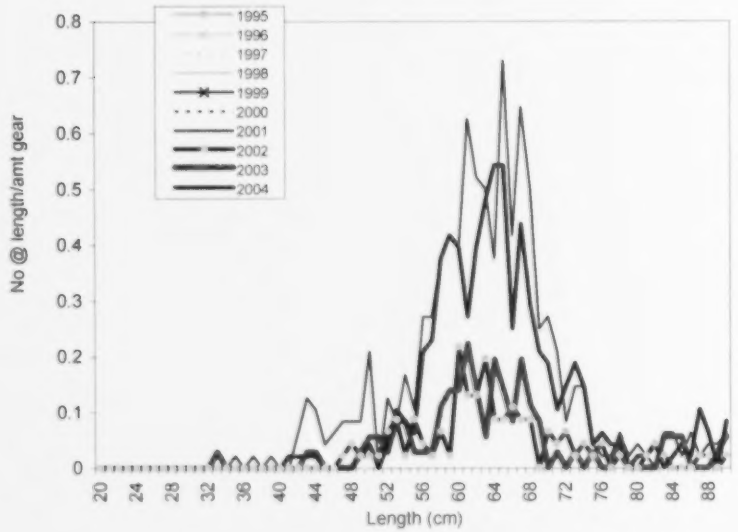
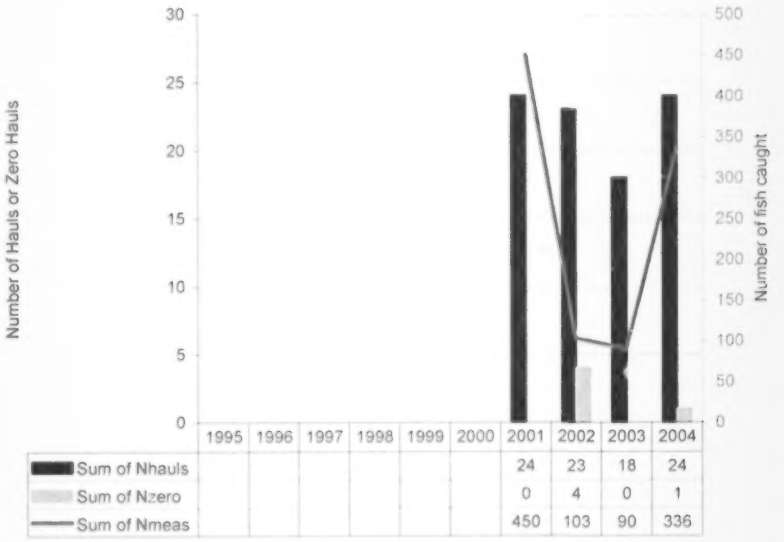


Figure 34. Relative length frequency (number at length / amount of gear) for control and experimental gears, Grand Bank Gillnet 5 1/2 in.



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Sum of Nhauls							24	23	18	24
Sum of Nzero							0	4	0	1
Sum of Nmeas							450	103	90	336

Figure 35. Number of hauls (Nhauls), number of zero catch hauls (Nzero) and total number of fish caught (Nmeas), for control and experimental gears, Grand Bank Gillnet 5 1/2 in.

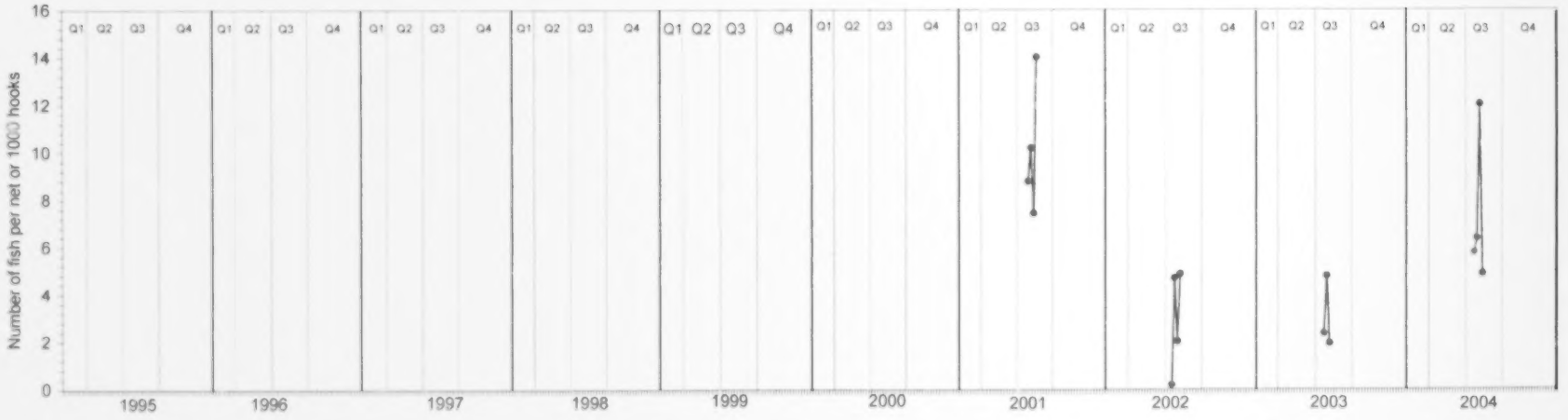


Figure 36. Catch per unit effort (in numbers of fish per net) for all sets (control and experimental) averaged for each week, Grand Bank Gillnet 5 1/2 in.

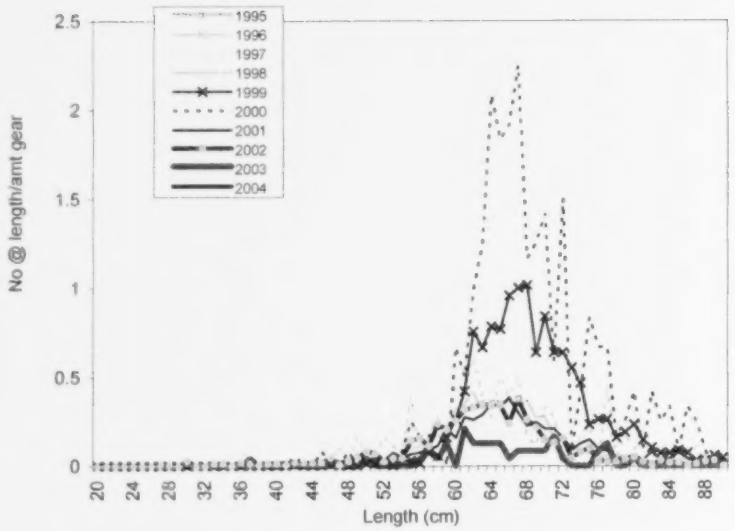
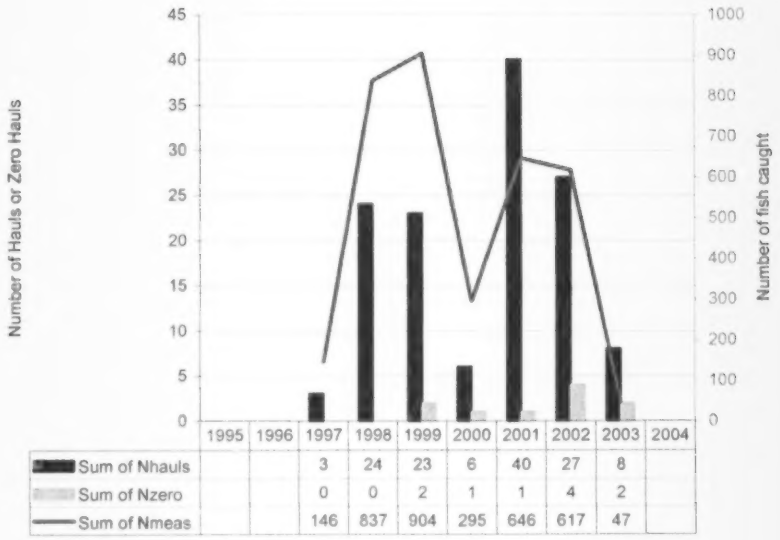


Figure 37. Relative length frequency (number at length / amount of gear) for control and experimental gears, Seal Cove Gillnet 5 1/2 in.



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Sum of Nhauls			3	24	23	6	40	27	8	
Sum of Nzero			0	0	2	1	1	4	2	
Sum of Nmeas			146	837	904	295	646	617	47	

Figure 38. Number of hauls (Nhauls), number of zero catch hauls (Nzero) and total number of fish caught (Nmeas), for control and experimental gears, Seal Cove Gillnet 5 1/2 in.

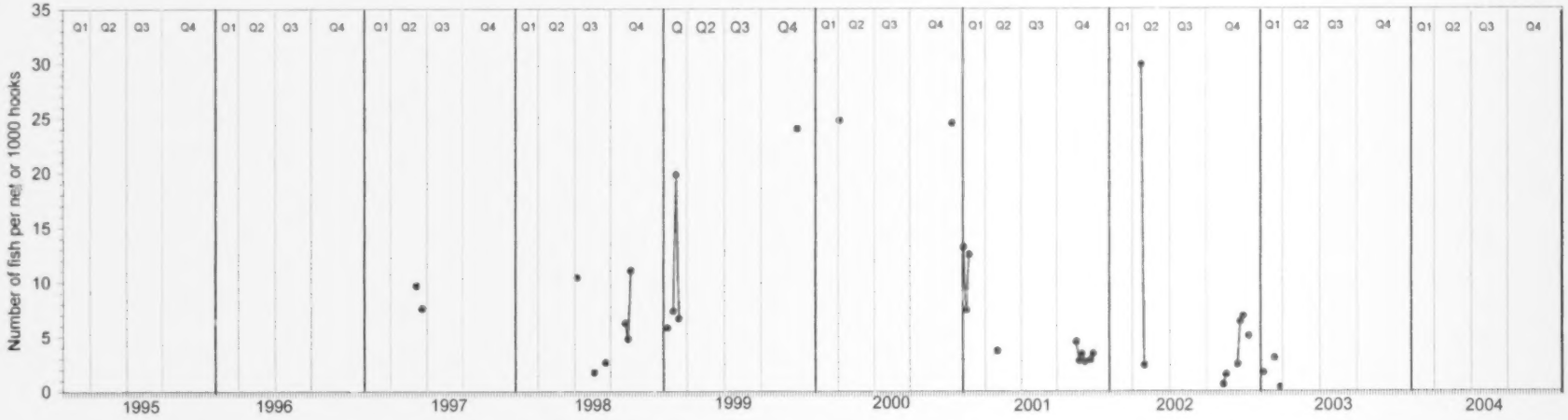


Figure 39. Catch per unit effort (in numbers of fish per net) for all sets (control and experimental) averaged for each week, Seal Cove Gillnet 5 1/2 in.

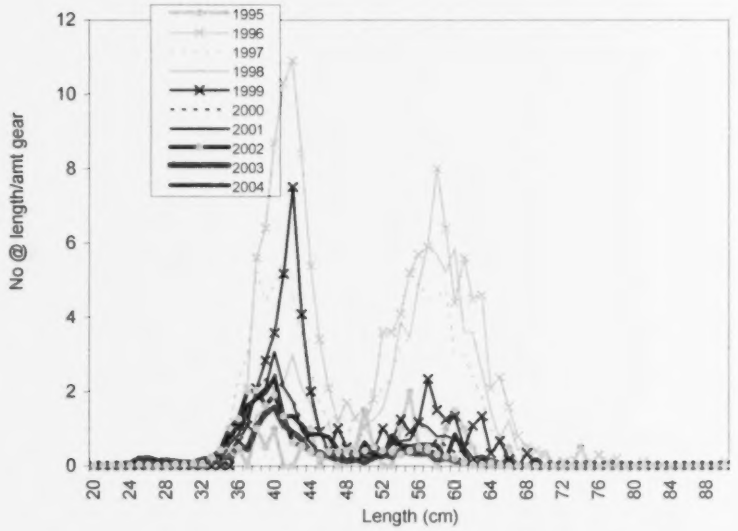
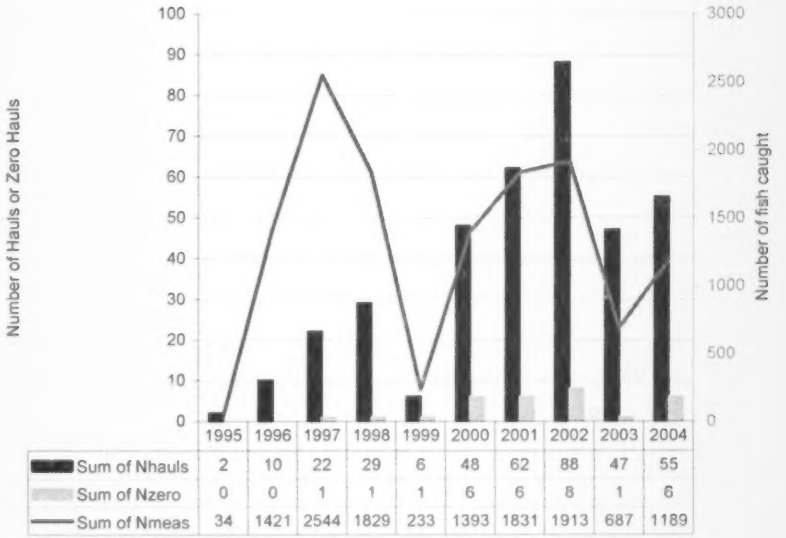


Figure 40. Relative length frequency (number at length / amount of gear) for control and experimental gears, 3Ps Gillnet 3 1/4 in.



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Sum of Nhauls	2	10	22	29	6	48	62	88	47	55
Sum of Nzero	0	0	1	1	1	6	6	8	1	6
Sum of Nmeas	34	1421	2544	1829	233	1393	1831	1913	687	1189

Figure 41. Number of hauls (Nhauls), number of zero catch hauls (Nzero) and total number of fish caught (Nmeas), for control and experimental gears, 3Ps Gillnet 3 1/4 in.

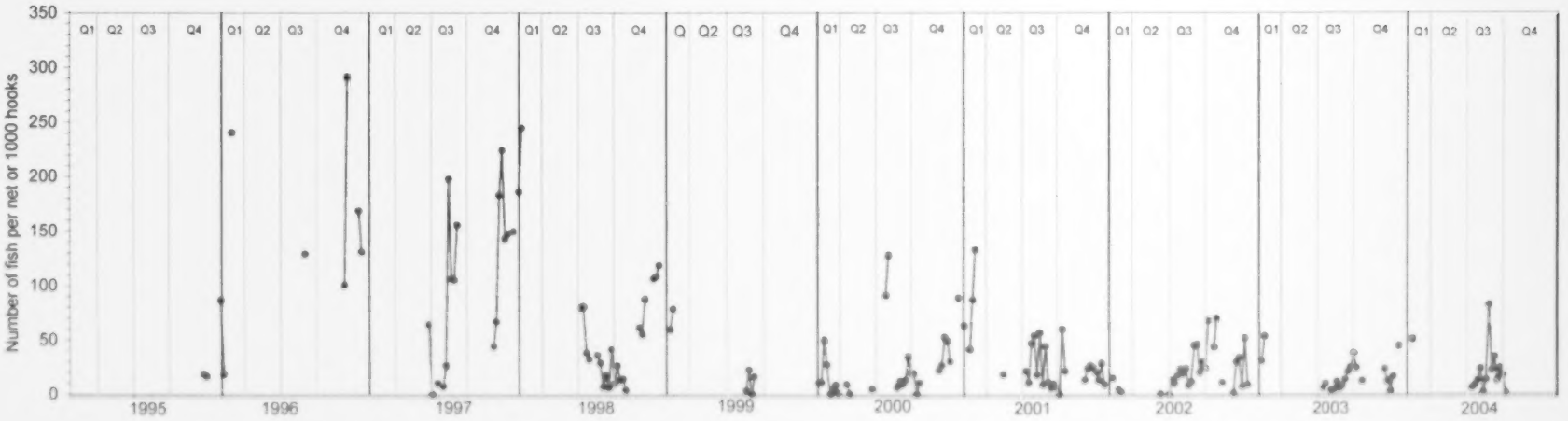


Figure 42. Catch per unit effort (in numbers of fish per net) for all sets (control and experimental) averaged for each week, 3Ps Gillnet 3 1/4 in.

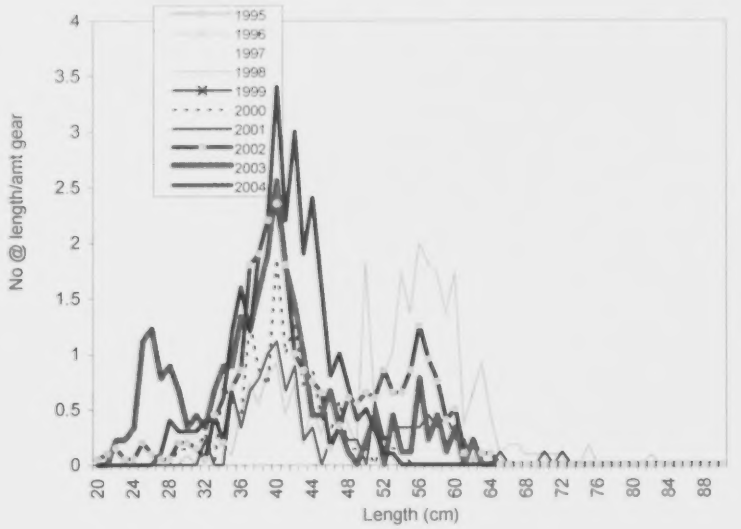
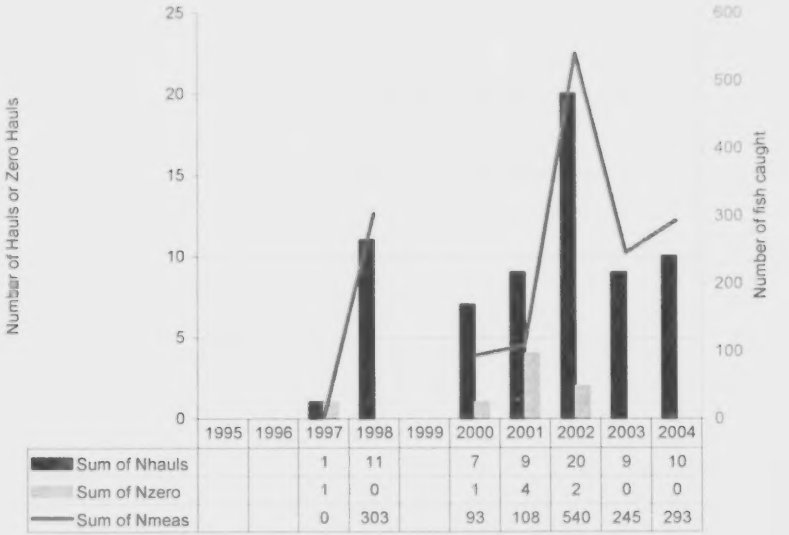


Figure 43. Relative length frequency (number at length / amount of gear) for control and experimental gears, St. Bride's Gillnet 3 1/4 in.



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Sum of Nhauls			1	11		7	9	20	9	10
Sum of Nzero			1	0		1	4	2	0	0
Sum of Nmeas			0	303		93	108	540	245	293

Figure 44. Number of hauls (Nhauls), number of zero catch hauls (Nzero) and total number of fish caught (Nmeas), for control and experimental gears, St. Bride's Gillnet 3 1/4 in.

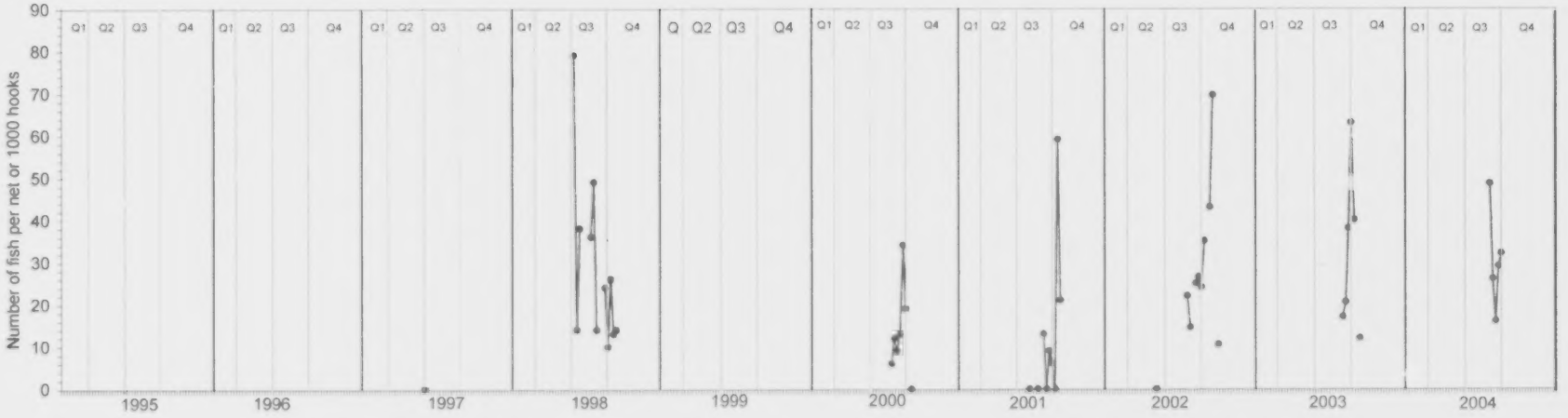


Figure 45. Catch per unit effort (in numbers of fish per net) for all sets (control and experimental) averaged for each week, St. Bride's Gillnet 3 1/4 in.

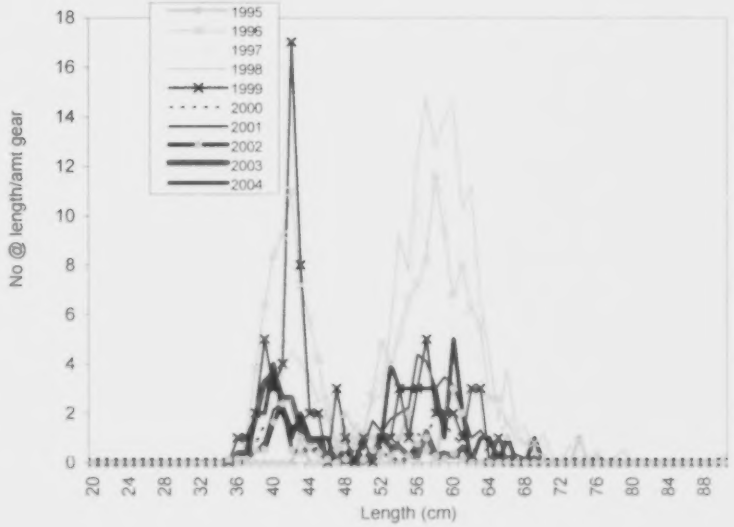
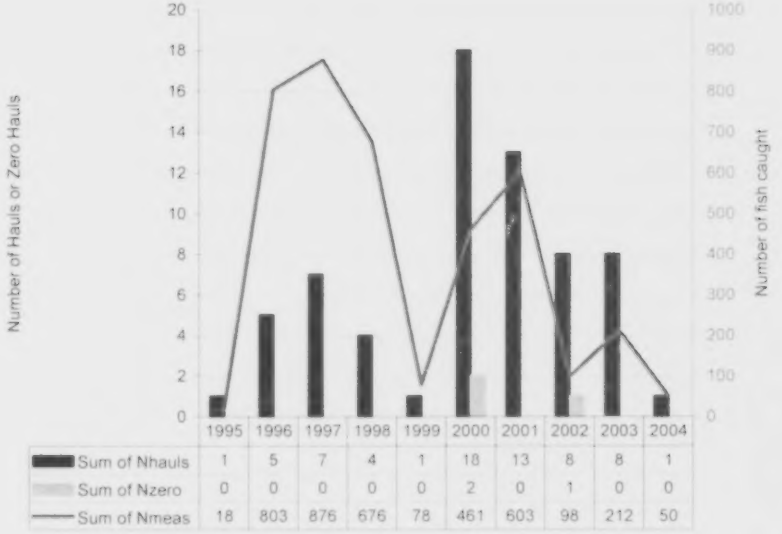


Figure 46. Relative length frequency (number at length / amount of gear) for control and experimental gears, North Hr Gillnet 3 1/4 in.



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Sum of Nhauls	1	5	7	4	1	18	13	8	8	1
Sum of Nzero	0	0	0	0	0	2	0	1	0	0
Sum of Nmeas	18	803	876	676	78	461	603	98	212	50

Figure 47. Number of hauls (Nhauls), number of zero catch hauls (Nzero) and total number of fish caught (Nmeas), for control and experimental gears, North Hr Gillnet 3 1/4 in.

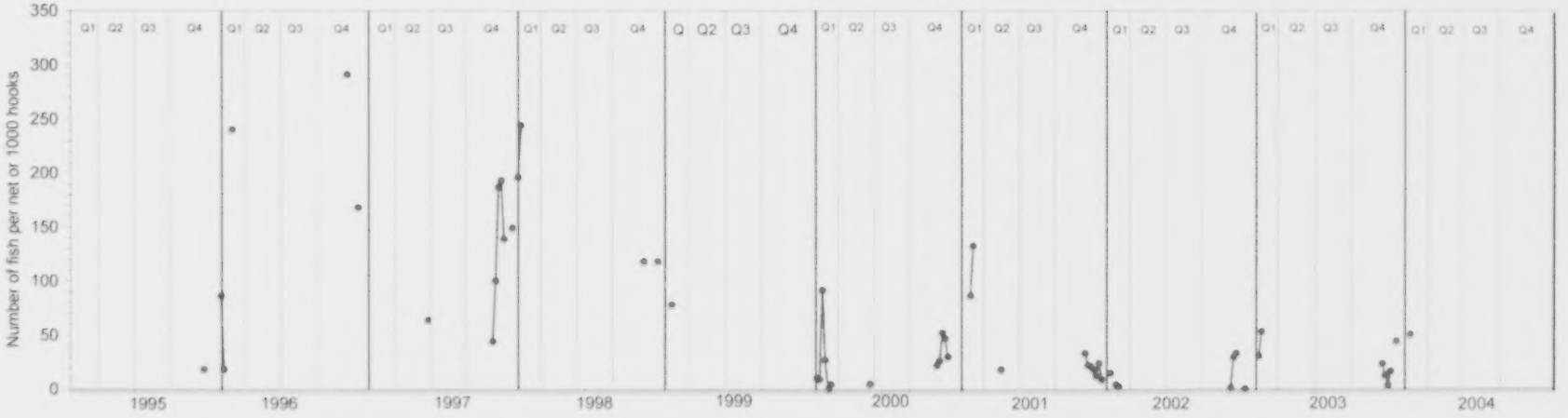


Figure 48. Catch per unit effort (in numbers of fish per net) for all sets (control and experimental) averaged for each week, North Hr Gillnet 3 1/4 in.

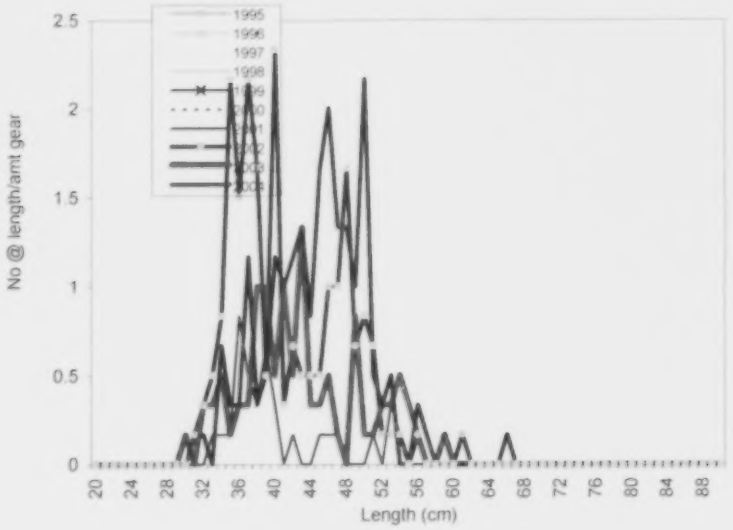


Figure 49. Relative length frequency (number at length / amount of gear) for control and experimental gears, Little Paradise Gillnet 3 1/4 in

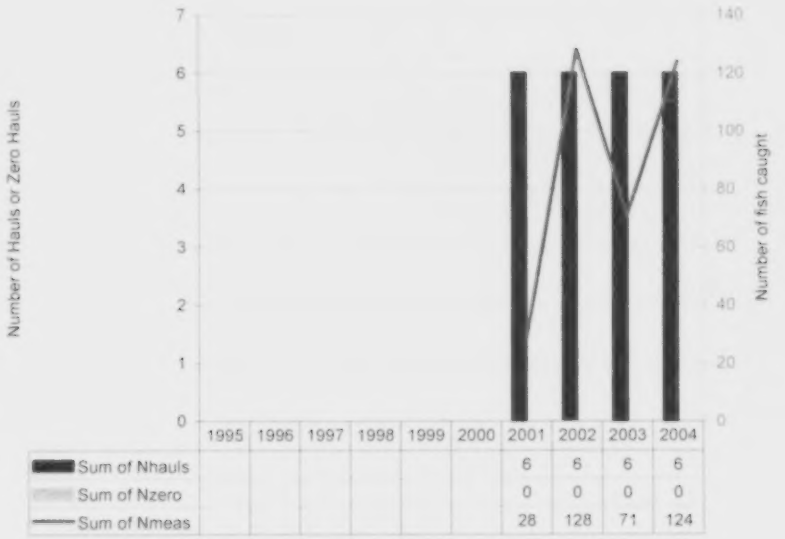

Number of Hauls or Zero Hauls
Number of fish caught
1995 1996 1997 1998 1999 2000 2001 2002 2003 2004
Sum of Nhauls 6 6 6 6
Sum of Nzero 0 0 0 0
Sum of Nmeas 28 128 71 124

Figure 50. Number of hauls (Nhauls), number of zero catch hauls (Nzero) and total number of fish caught (Nmeas), for control and experimental gears, Little Paradise Gillnet 3 1/4 in.

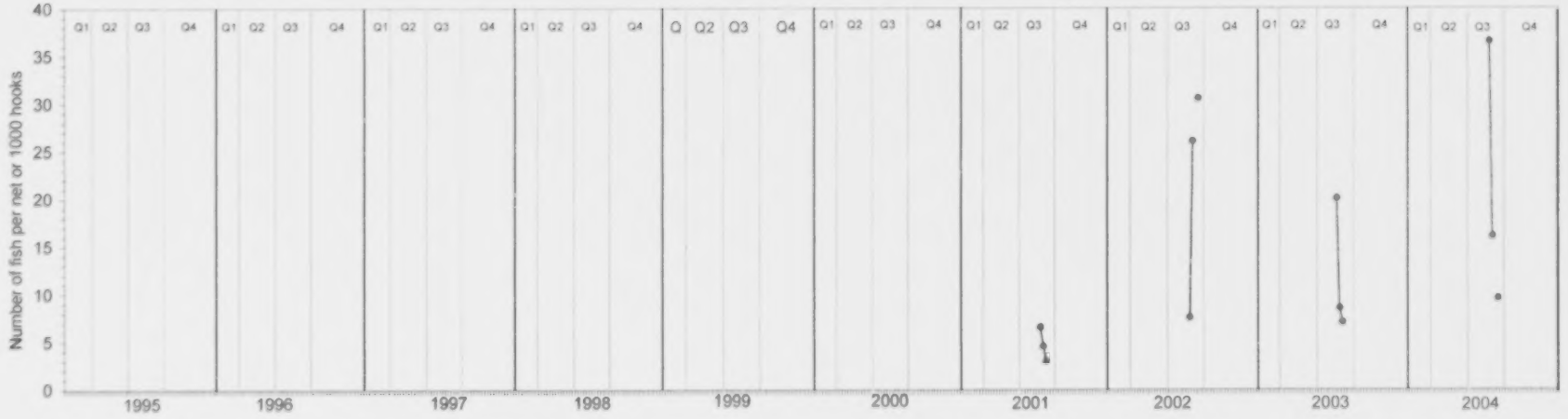


Figure 51. Catch per unit effort (in numbers of fish per net) for all sets (control and experimental) averaged for each week, Little Paradise Gillnet 3 1/4 in.

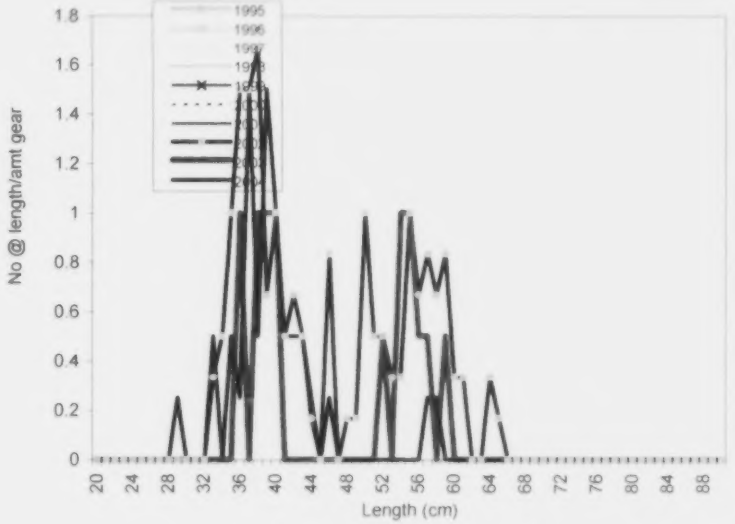


Figure 52. Relative length frequency (number at length / amount of gear) for control and experimental gears, Red Hr Gillnet 3 1/4 in.

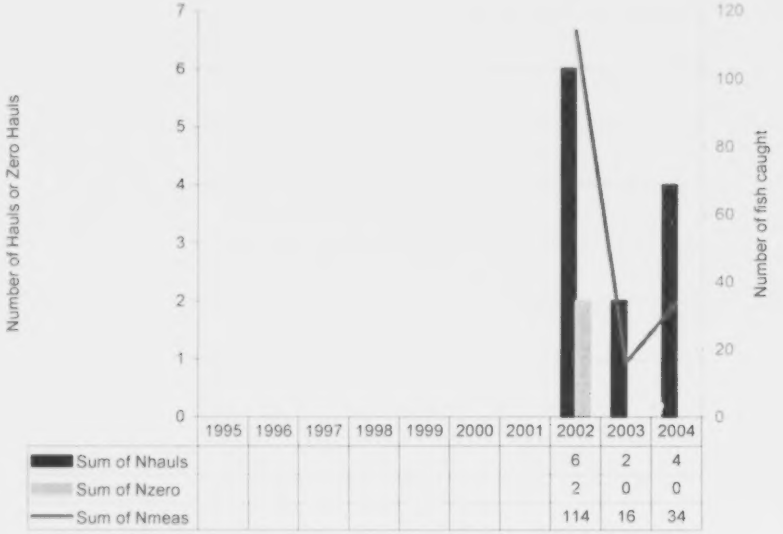

Number of Hauls or Zero Hauls
Number of fish caught
1995 1996 1997 1998 1999 2000 2001 2002 2003 2004
Sum of Nhauls 6 2 4
Sum of Nzero 2 0 0
Sum of Nmeas 114 16 34

Figure 53. Number of hauls (Nhauls), number of zero catch hauls (Nzero) and total number of fish caught (Nmeas), for control and experimental gears, Red Hr Gillnet 3 1/4 in.

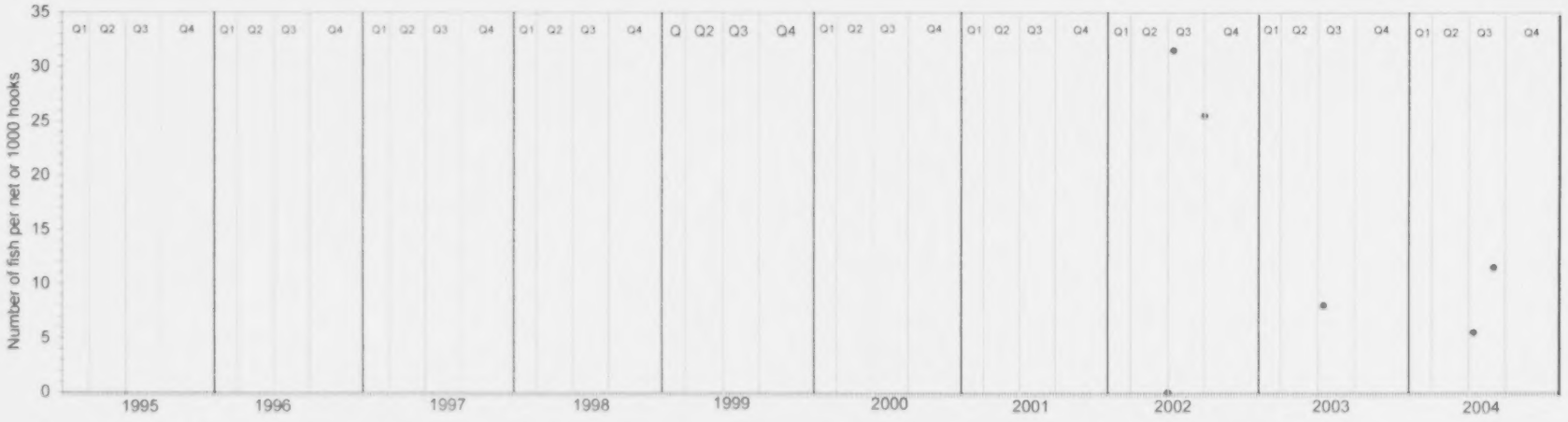


Figure 54. Catch per unit effort (in numbers of fish per net) for all sets (control and experimental) averaged for each week, Red Hr Gillnet 3 1/4 in.

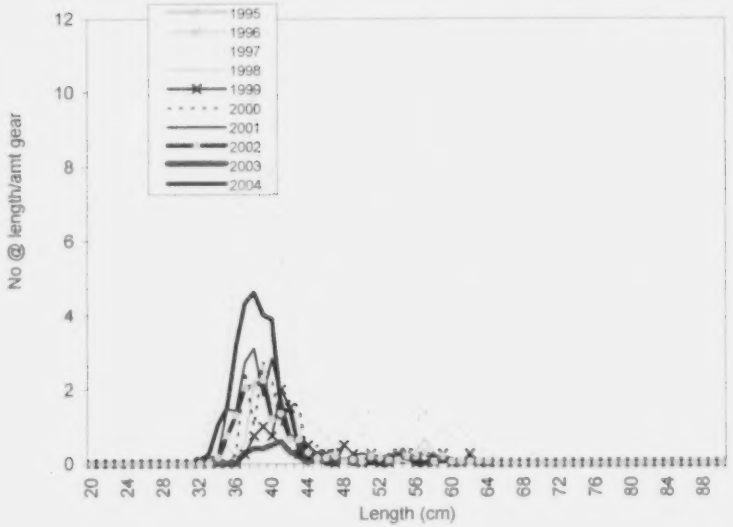
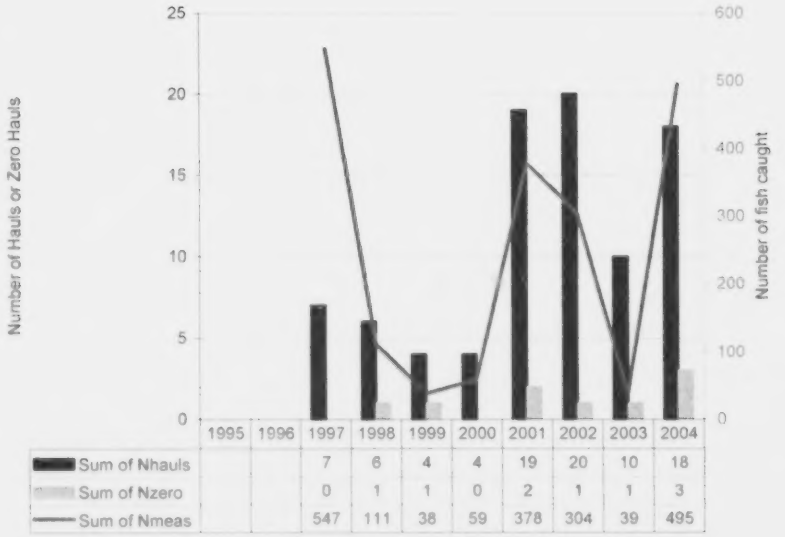


Figure 55. Relative length frequency (number at length / amount of gear) for control and experimental gears, Lawn Gillnet 3 1/4 in.



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Sum of Nhauls			7	6	4	4	19	20	10	18
Sum of Nzero			0	1	1	0	2	1	1	3
Sum of Nmeas			547	111	38	59	378	304	39	495

Figure 56. Number of hauls (Nhauls), number of zero catch hauls (Nzero) and total number of fish caught (Nmeas), for control and experimental gears, Lawn Gillnet 3 1/4 in.

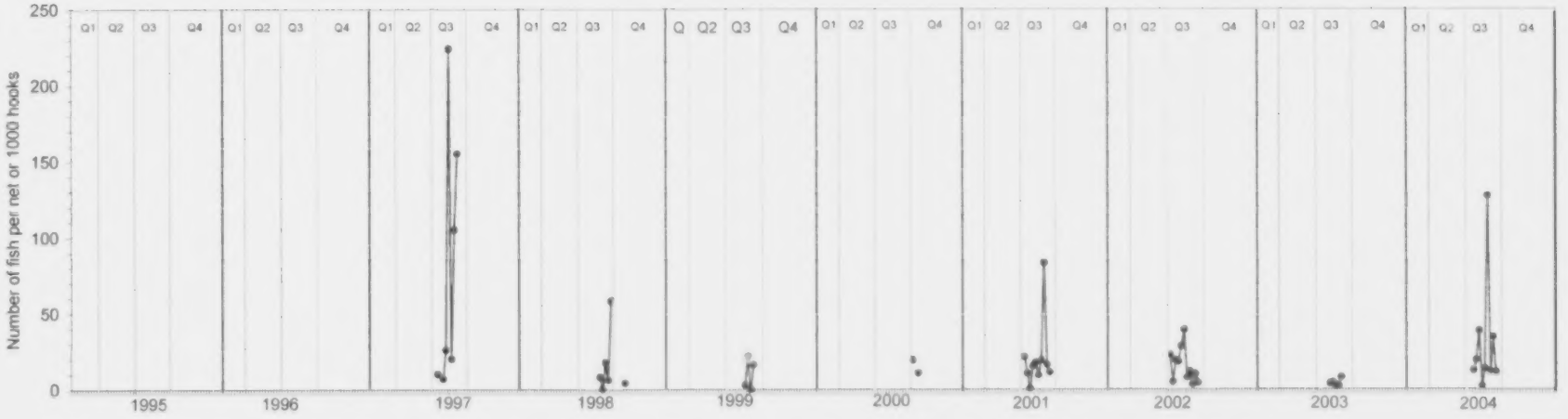


Figure 57. Catch per unit effort (in numbers of fish per net) for all sets (control and experimental) averaged for each week, Lawn Gillnet 3 1/4 in.

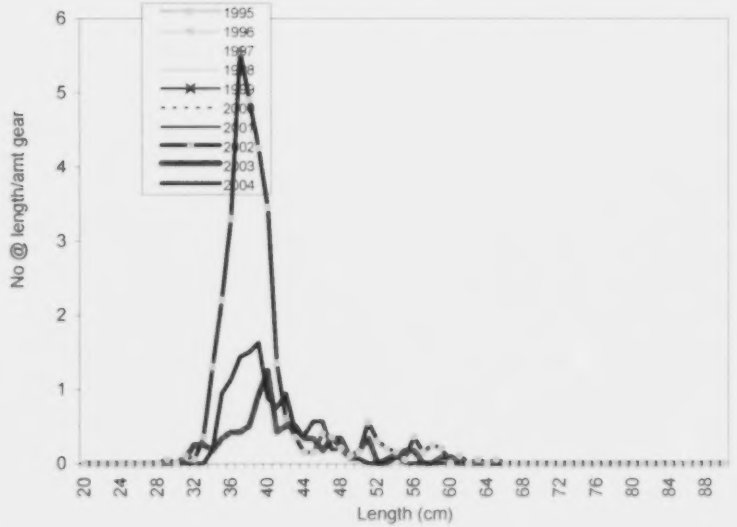


Figure 58. Relative length frequency (number at length / amount of gear) for control and experimental gears, Lord's Cove Gillnet 3 1/4 in.

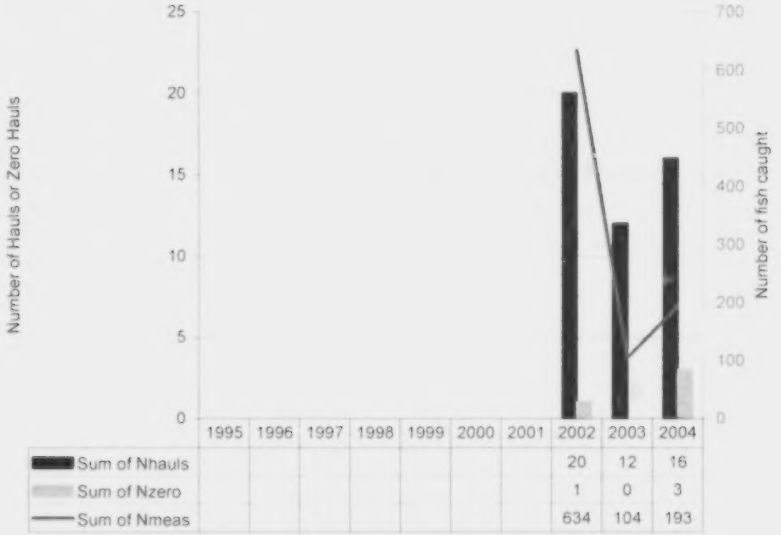

Number of Hauls or Zero Hauls
Number of fish caught
1995 1996 1997 1998 1999 2000 2001 2002 2003 2004
Sum of Nhauls 20 12 16
Sum of Nzero 1 0 3
Sum of Nmeas 634 104 193

Figure 59. Number of hauls (Nhauls), number of zero catch hauls (Nzero) and total number of fish caught (Nmeas), for control and experimental gears, Lord's Cove Gillnet 3 1/4 in.

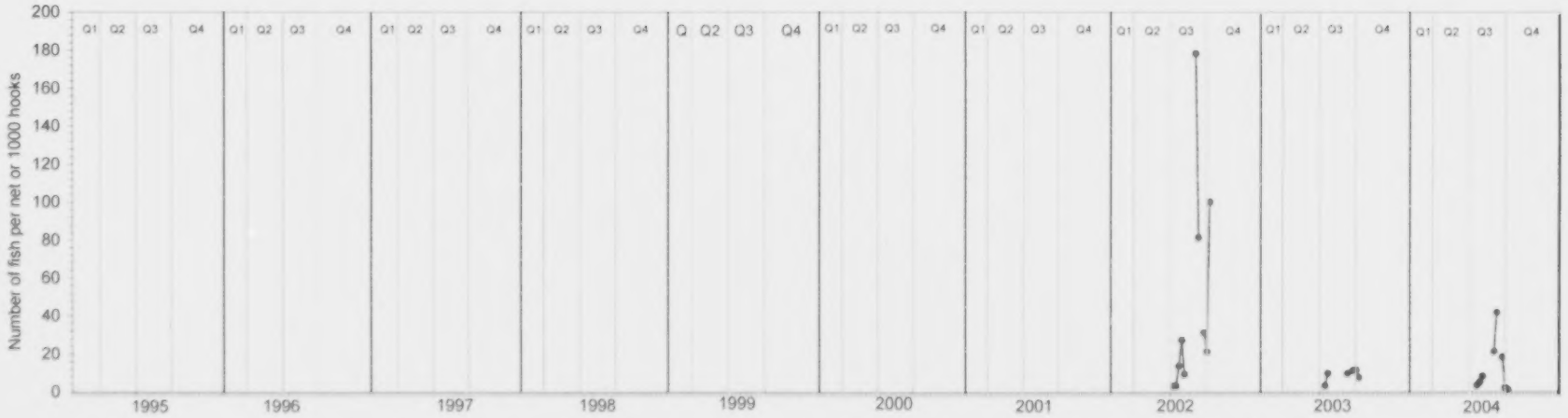


Figure 60. Catch per unit effort (in numbers of fish per net) for all sets (control and experimental) averaged for each week, Lord's Cove Gillnet 3 1/4 in.

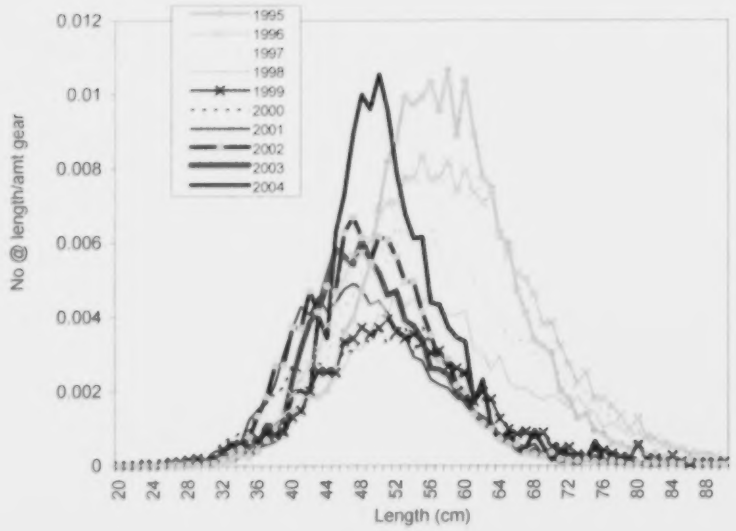
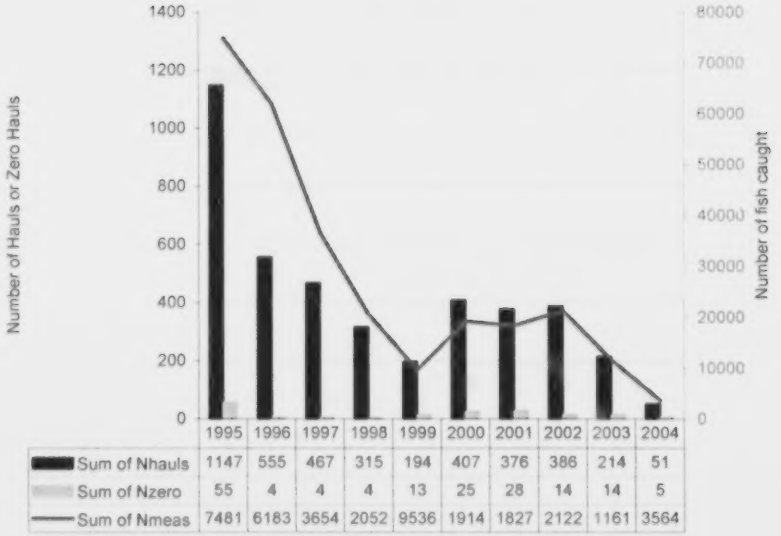


Figure 61. Relative length frequency (number at length / amount of gear) for control and experimental gears, 3Ps Linetrawl.



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Sum of Nhauls	1147	555	467	315	194	407	376	386	214	51
Sum of Nzero	55	4	4	4	13	25	28	14	14	5
Sum of Nmeas	7481	6183	3654	2052	9536	1914	1827	2122	1161	3564

Figure 62. Number of hauls (Nhauls), number of zero catch hauls (Nzero) and total number of fish caught (Nmeas), for control and experimental gears, 3Ps Linetrawl.

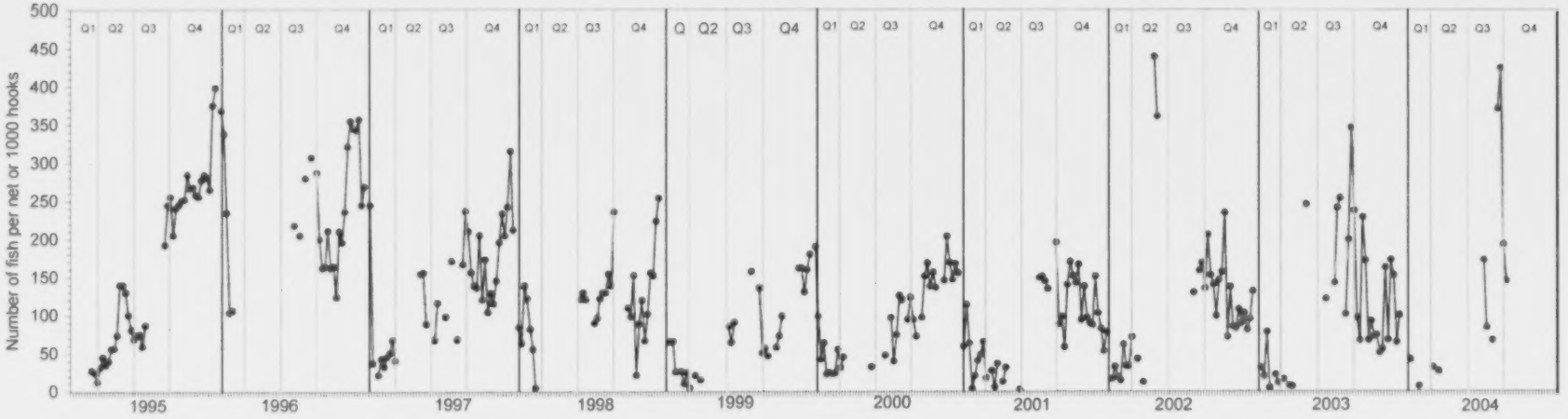


Figure 63. Catch per unit effort (in numbers of fish per 1000 hooks) for all sets (control and experimental) averaged for each week, 3Ps Linetrawl.

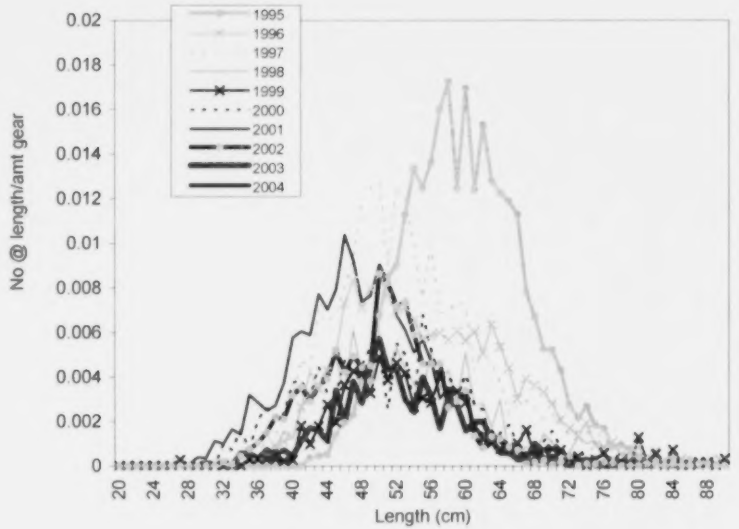
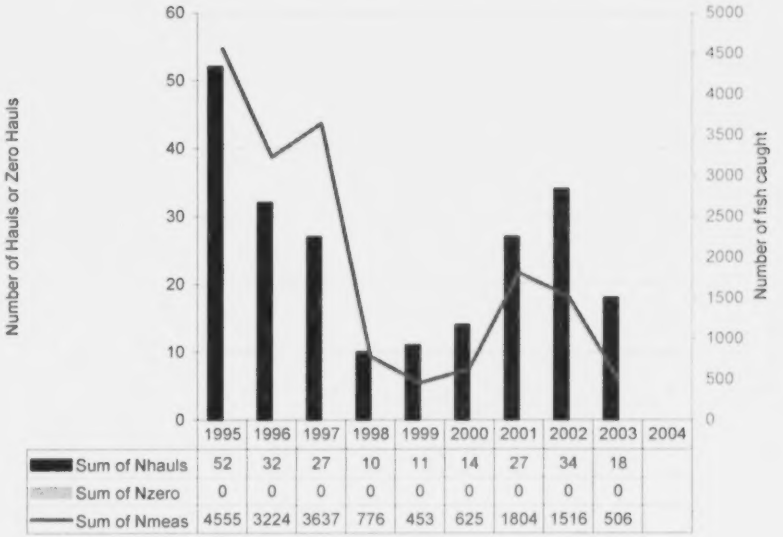


Figure 64. Relative length frequency (number at length / amount of gear) for control and experimental gears, Little Paradise Linetrawl.



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Sum of Nhauls	52	32	27	10	11	14	27	34	18	
Sum of Nzero	0	0	0	0	0	0	0	0	0	
Sum of Nmeas	4555	3224	3637	776	453	625	1804	1516	506	

Figure 65. Number of hauls (Nhauls), number of zero catch hauls (Nzero) and total number of fish caught (Nmeas), for control and experimental gears, Little Paradise Linetrawl.

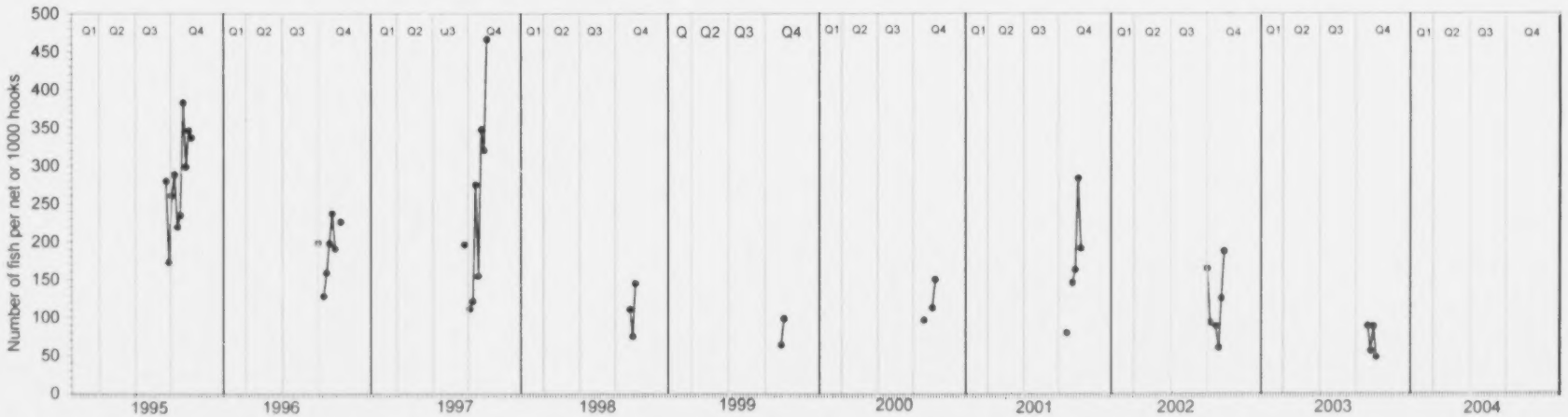


Figure 66. Catch per unit effort (in numbers of fish per 1000 hooks) for all sets (control and experimental) averaged for each week, Little Paradise Linetrawl.

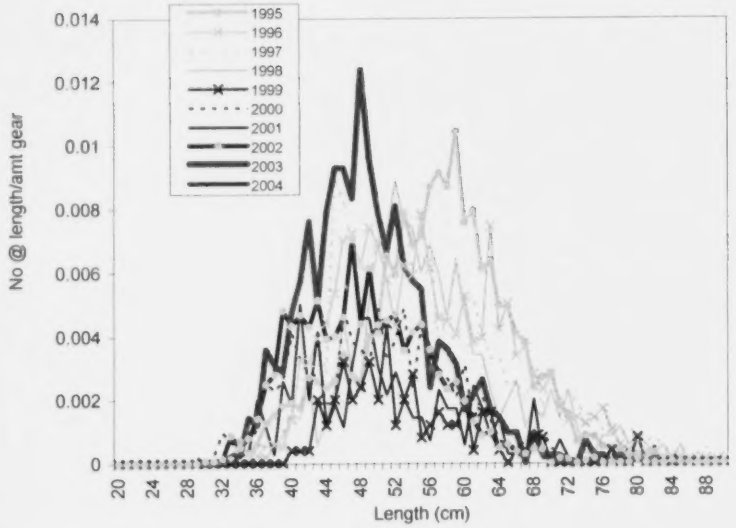
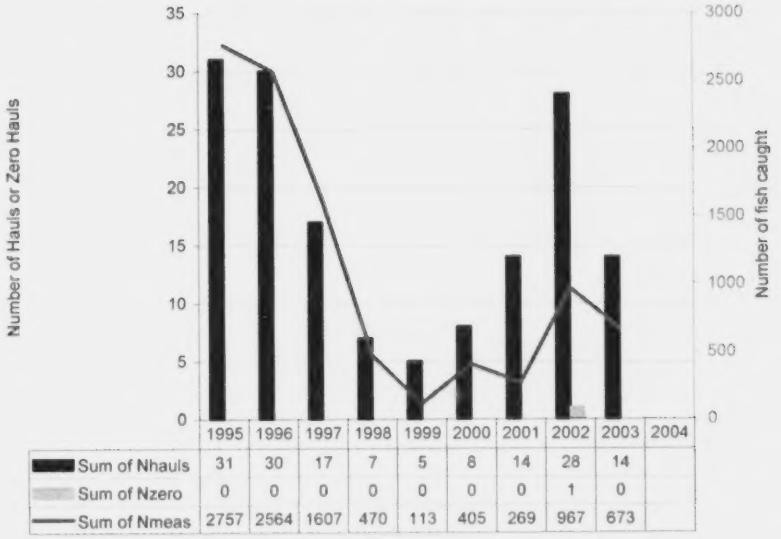


Figure 67. Relative length frequency (number at length / amount of gear) for control and experimental gears, Red Hr Linetrawl .



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Sum of Nhauls	31	30	17	7	5	8	14	28	14	
Sum of Nzero	0	0	0	0	0	0	0	1	0	
Sum of Nmeas	2757	2564	1607	470	113	405	269	967	673	

Figure 68. Number of hauls (Nhauls), number of zero catch hauls (Nzero) and total number of fish caught (Nmeas), for control and experimental gears, Red Hr Linetrawl .

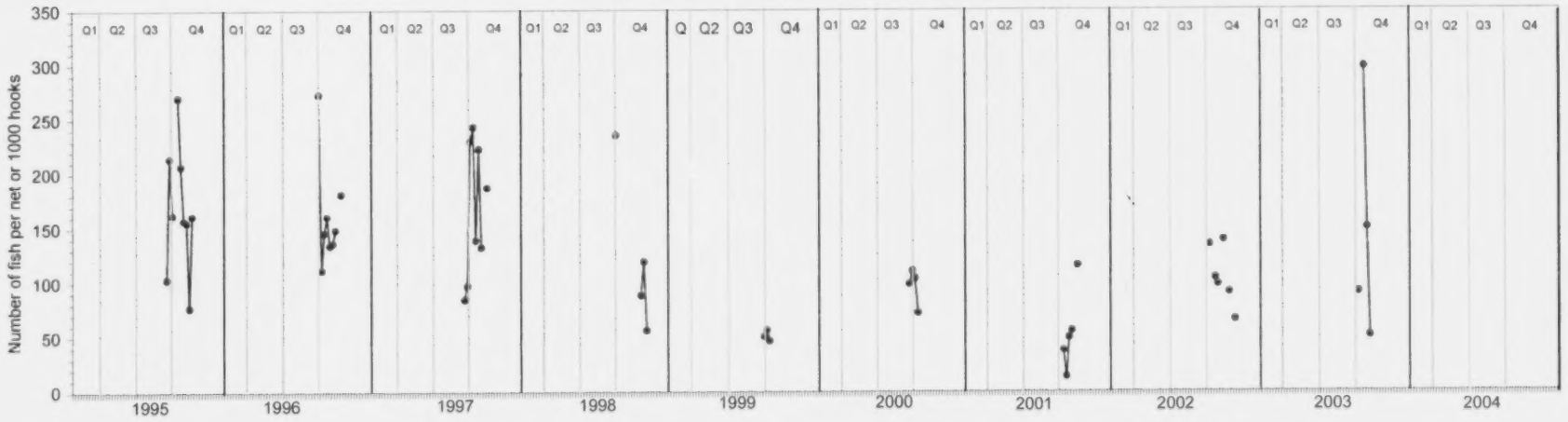


Figure 69. Catch per unit effort (in numbers of fish per 1000 hooks) for all sets (control and experimental) averaged for each week, Red Hr Linetrawl .

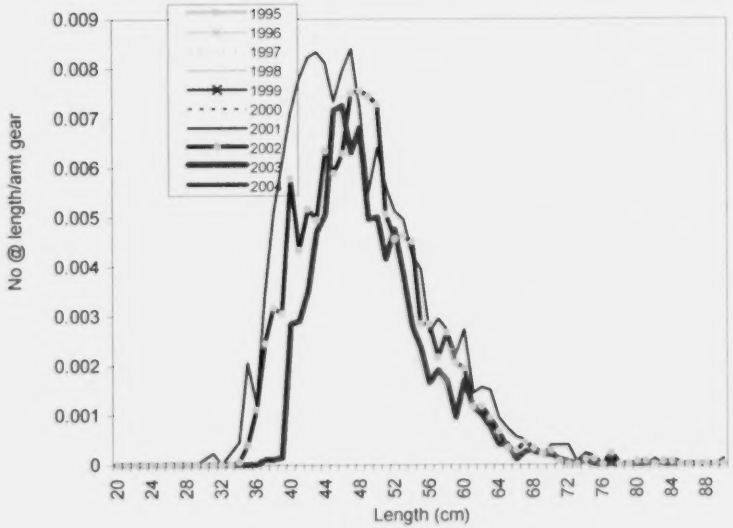


Figure 70. Relative length frequency (number at length / amount of gear) for control and experimental gears, Grand Bank Linetrawl .

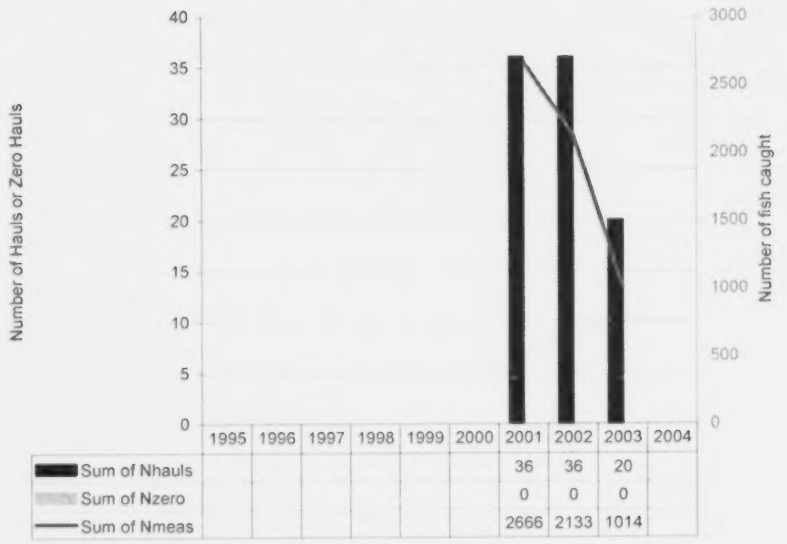

Number of Hauls or Zero Hauls
Number of fish caught
1995 1996 1997 1998 1999 2000 2001 2002 2003 2004
Sum of Nhauls 36 36 20
Sum of Nzero 0 0 0
Sum of Nmeas 2666 2133 1014

Figure 71. Number of hauls (Nhauls), number of zero catch hauls (Nzero) and total number of fish caught (Nmeas), for control and experimental gears, Grand Bank Linetrawl .

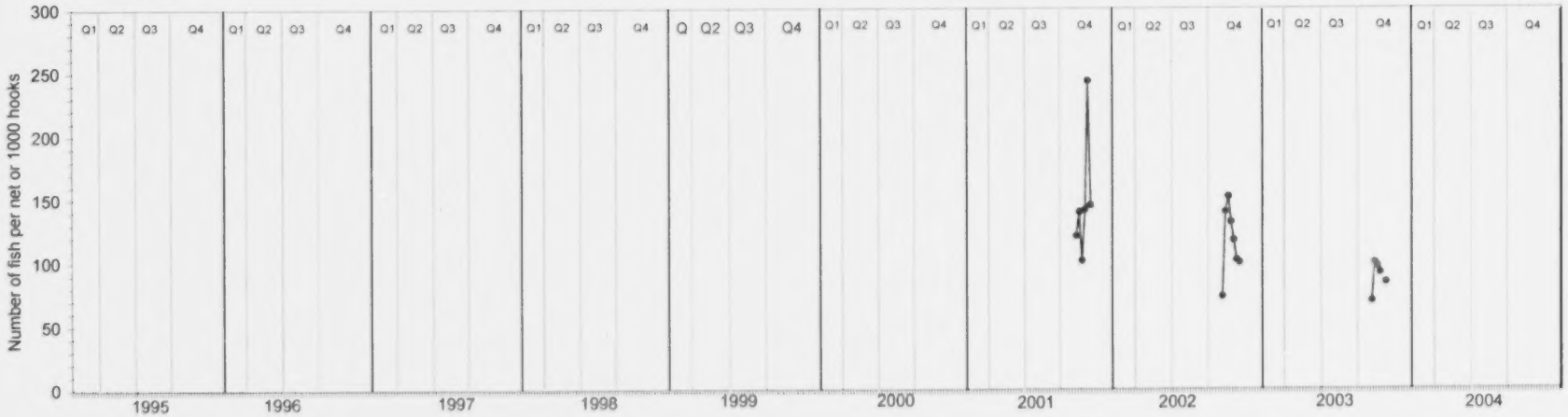


Figure 72. Catch per unit effort (in numbers of fish per 1000 hooks) for all sets (control and experimental) averaged for each week, Grand Bank Linetrawl .

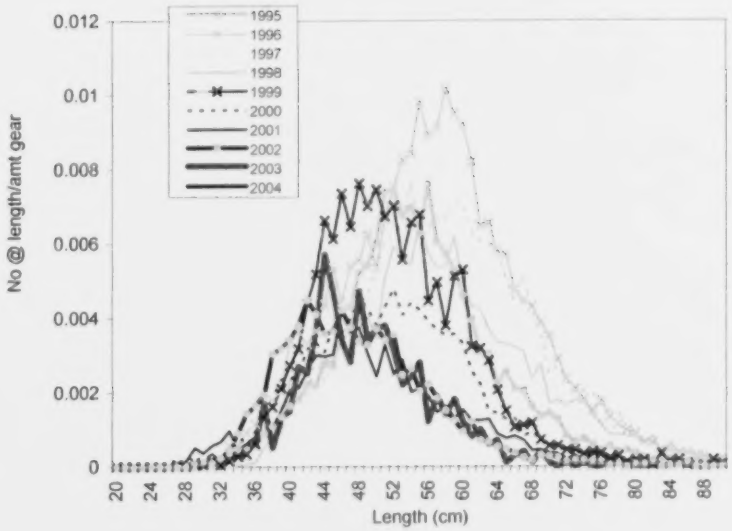
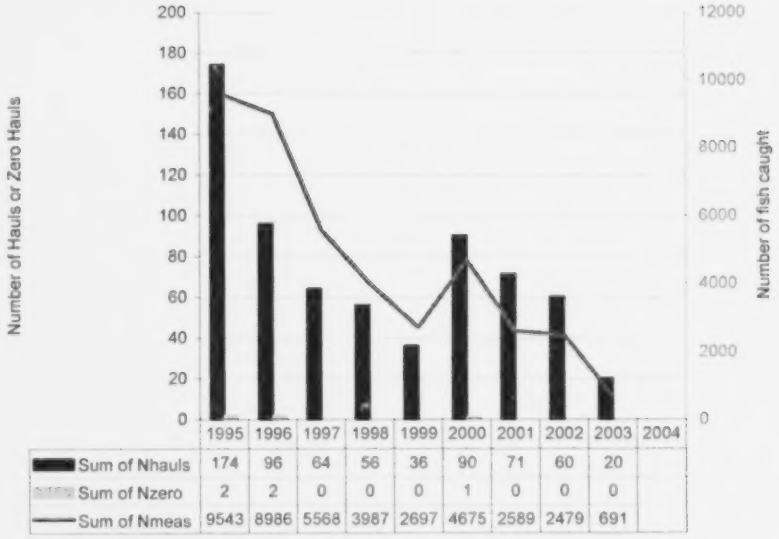


Figure 73. Relative length frequency (number at length / amount of gear) for control and experimental gears, Rencontre East Linetrawl .



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Sum of Nhauls	174	96	64	56	36	90	71	60	20	
Sum of Nzero	2	2	0	0	0	1	0	0	0	
Sum of Nmeas	9543	8986	5568	3987	2697	4675	2589	2479	691	

Figure 74. Number of hauls (Nhauls), number of zero catch hauls (Nzero) and total number of fish caught (Nmeas), for control and experimental gears, Rencontre East Linetrawl .

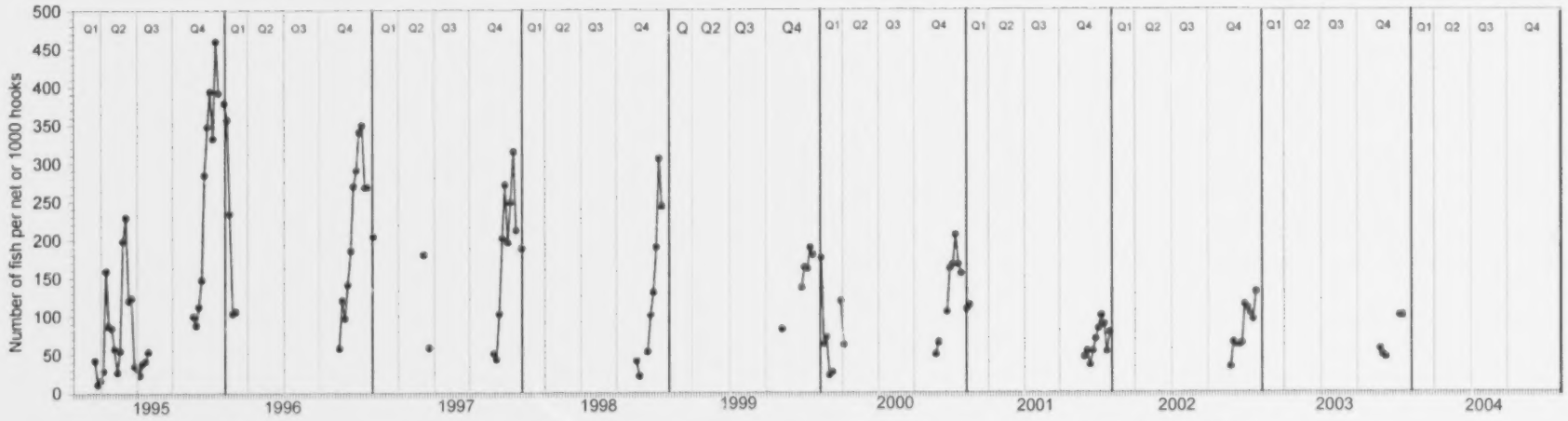


Figure 75. Catch per unit effort (in numbers of fish per 1000 hooks) for all sets (control and experimental) averaged for each week, Rencontre East Linetrawl .

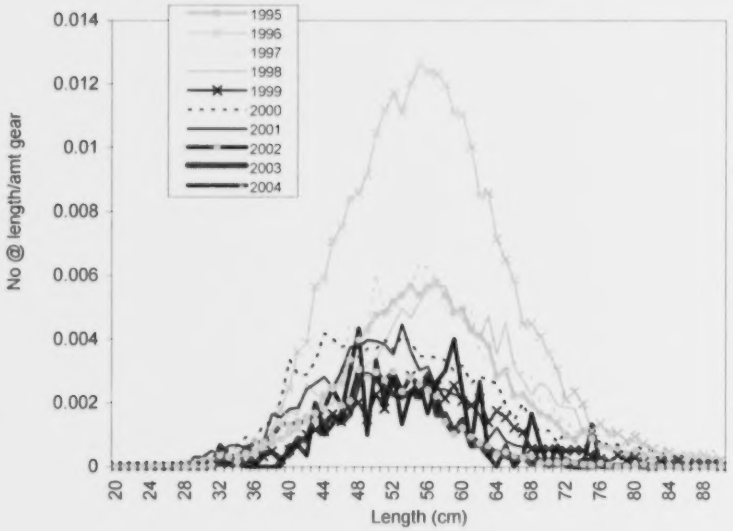
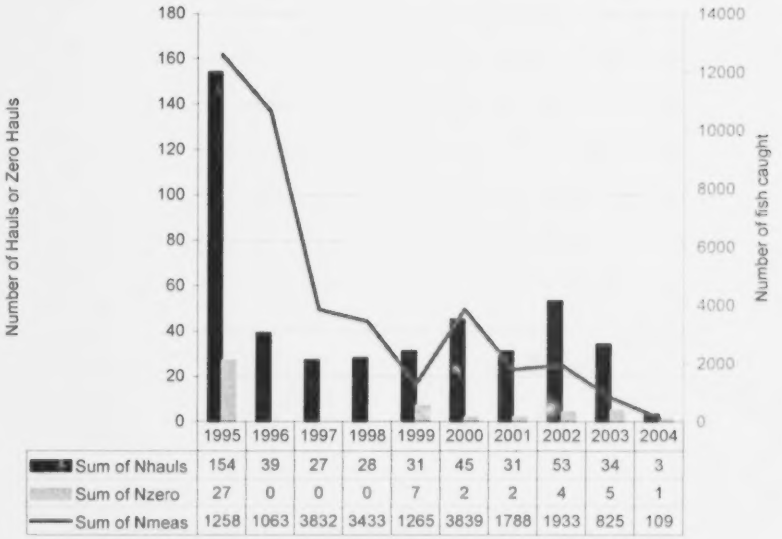


Figure 76. Relative length frequency (number at length / amount of gear) for control and experimental gears, Hr Breton Linetrawl .



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Sum of Nhauls	154	39	27	28	31	45	31	53	34	3
Sum of Nzero	27	0	0	0	7	2	2	4	5	1
Sum of Nmeas	1258	1063	3832	3433	1265	3839	1788	1933	825	109

Figure 77. Number of hauls (Nhauls), number of zero catch hauls (Nzero) and total number of fish caught (Nmeas), for control and experimental gears, Hr Breton Linetrawl .

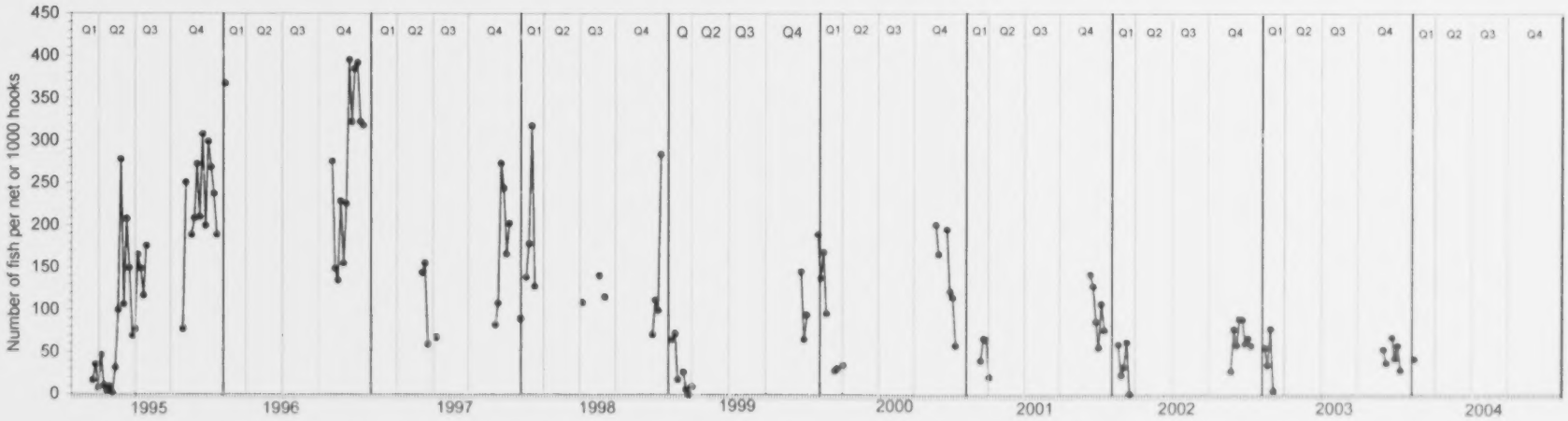


Figure 78. Catch per unit effort (in numbers of fish per 1000 hooks) for all sets (control and experimental) averaged for each week, Hr Breton Linetrawl .

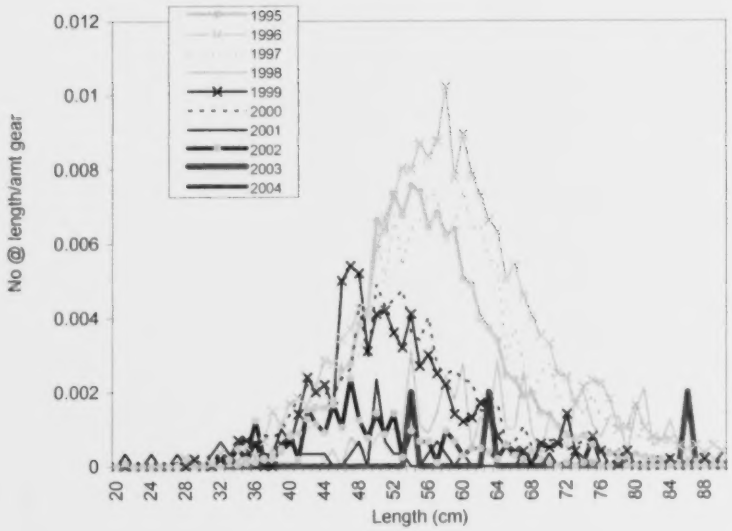
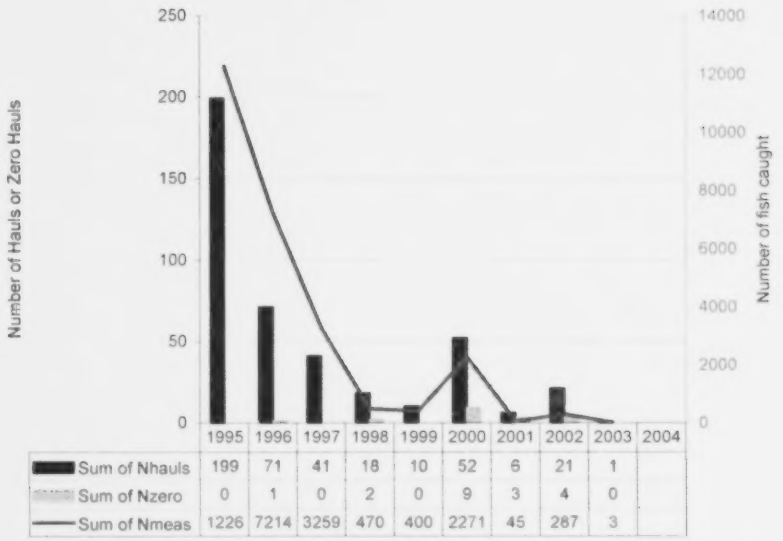


Figure 79. Relative length frequency (number at length / amount of gear) for control and experimental gears, Seal Cove Linetrawl .



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Sum of Nhauls	199	71	41	18	10	52	6	21	1	
Sum of Nzero	0	1	0	2	0	9	3	4	0	
Sum of Nmeas	1226	7214	3259	470	400	2271	45	287	3	

Figure 80. Number of hauls (Nhauls), number of zero catch hauls (Nzero) and total number of fish caught (Nmeas), for control and experimental gears, Seal Cove Linetrawl .

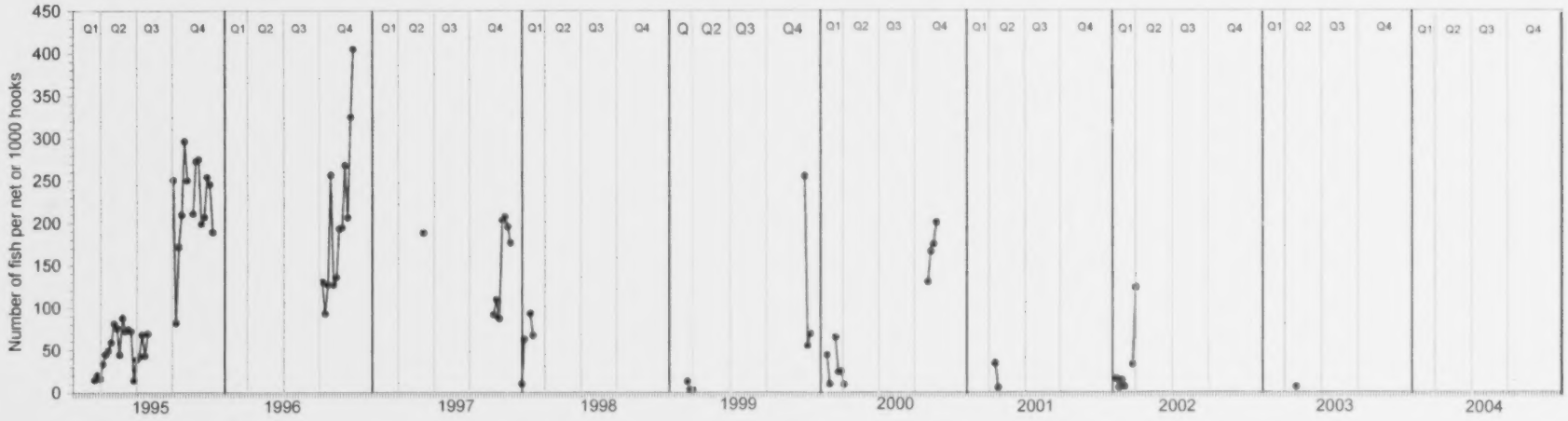


Figure 81. Catch per unit effort (in numbers of fish per 1000 hooks) for all sets (control and experimental) averaged for each week, Seal Cove Linetrawl .

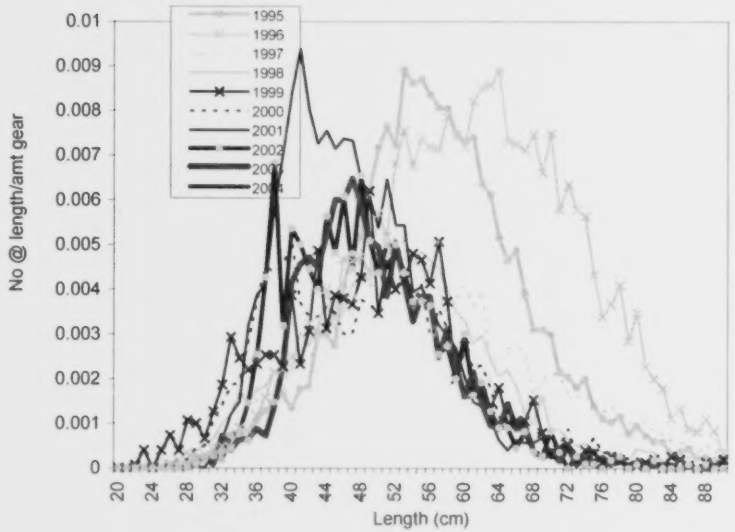
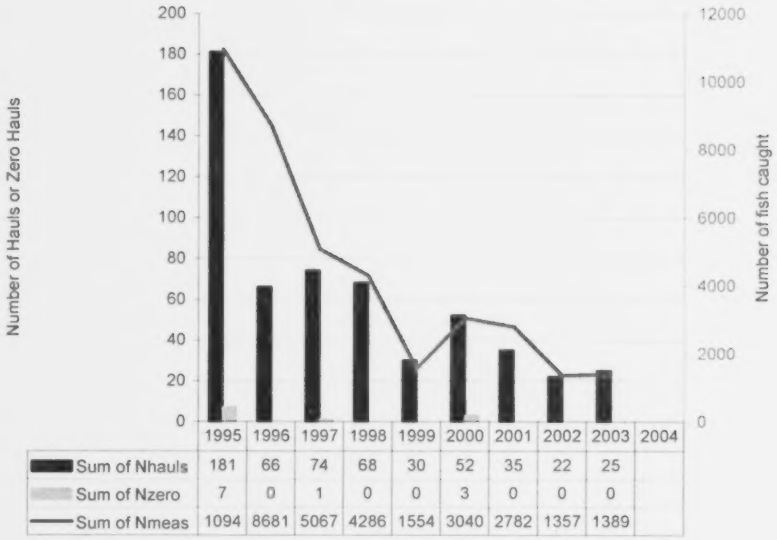


Figure 82. Relative length frequency (number at length / amount of gear) for control and experimental gears, Francois Linetrawl.



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Sum of Nhauls	181	66	74	68	30	52	35	22	25	
Sum of Nzero	7	0	1	0	0	3	0	0	0	
Sum of Nmeas	1094	8681	5067	4286	1554	3040	2782	1357	1389	

Figure 83. Number of hauls (Nhauls), number of zero catch hauls (Nzero) and total number of fish caught (Nmeas), for control and experimental gears, Francois Linetrawl.

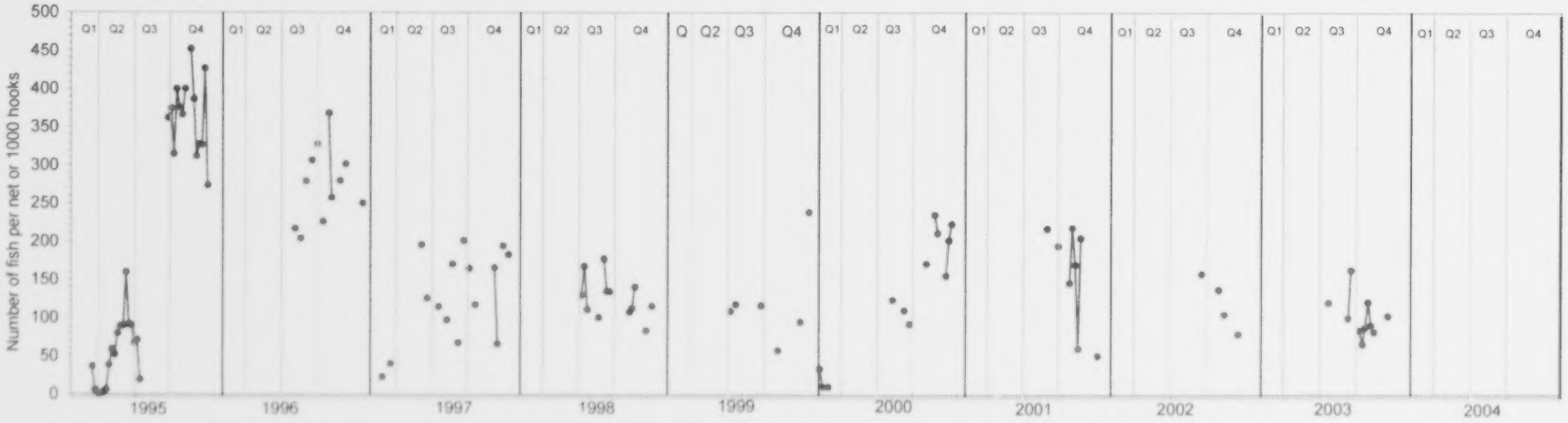


Figure 84. Catch per unit effort (in numbers of fish per 1000 hooks) for all sets (control and experimental) averaged for each week, Francois Linetrawl.

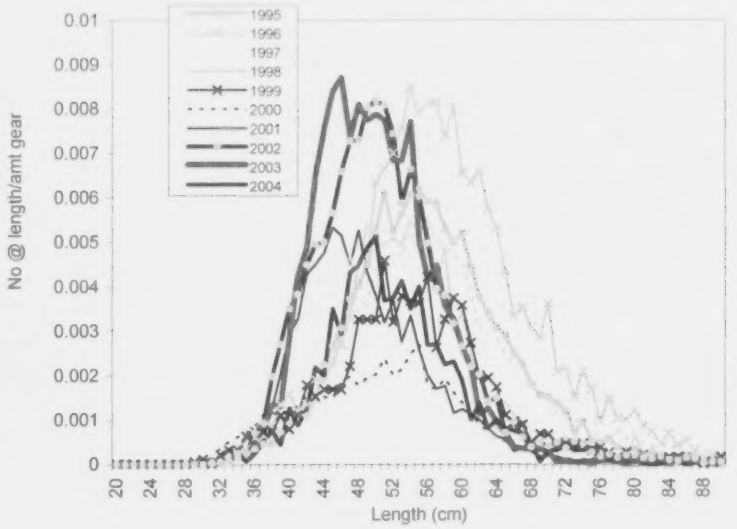
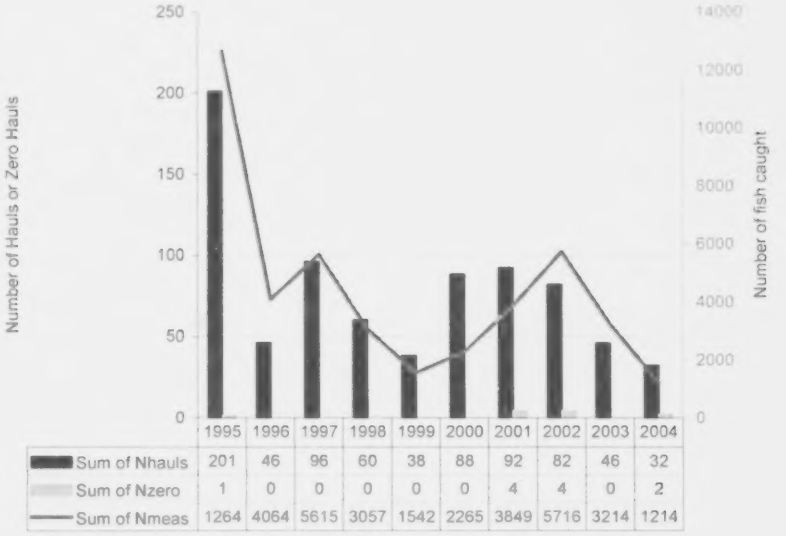


Figure 85. Relative length frequency (number at length / amount of gear) for control and experimental gears, Ramea Linetrawl .



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Sum of Nhauls	201	46	96	60	38	88	92	82	46	32
Sum of Nzero	1	0	0	0	0	0	4	4	0	2
Sum of Nmeas	1264	4064	5615	3057	1542	2265	3849	5716	3214	1214

Figure 86. Number of hauls (Nhauls), number of zero catch hauls (Nzero) and total number of fish caught (Nmeas), for control and experimental gears, Ramea Linetrawl .

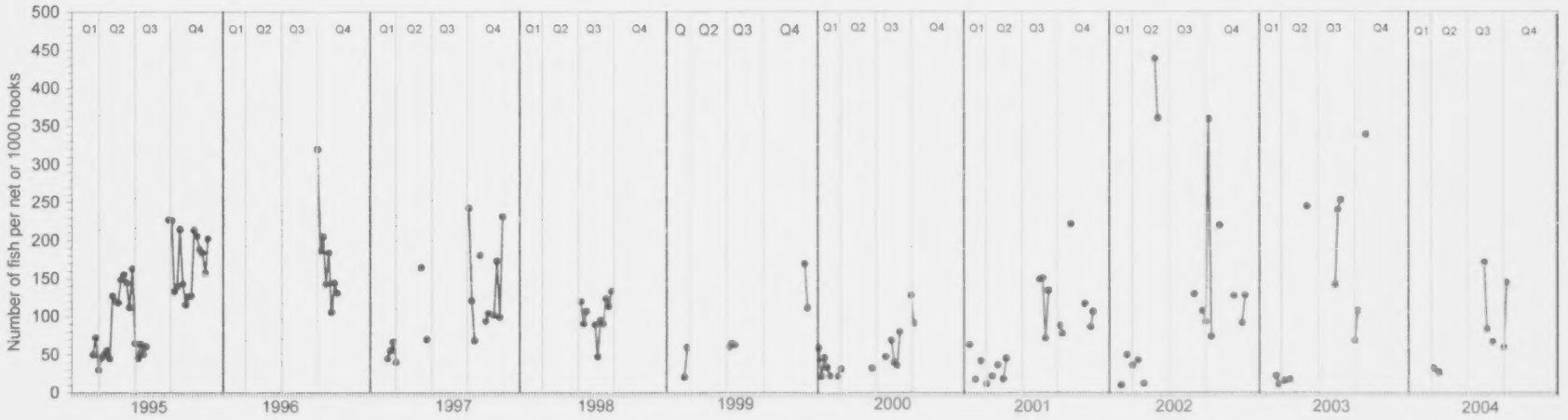


Figure 87. Catch per unit effort (in numbers of fish per 1000 hooks) for all sets (control and experimental) averaged for each week, Ramea Linetrawl .

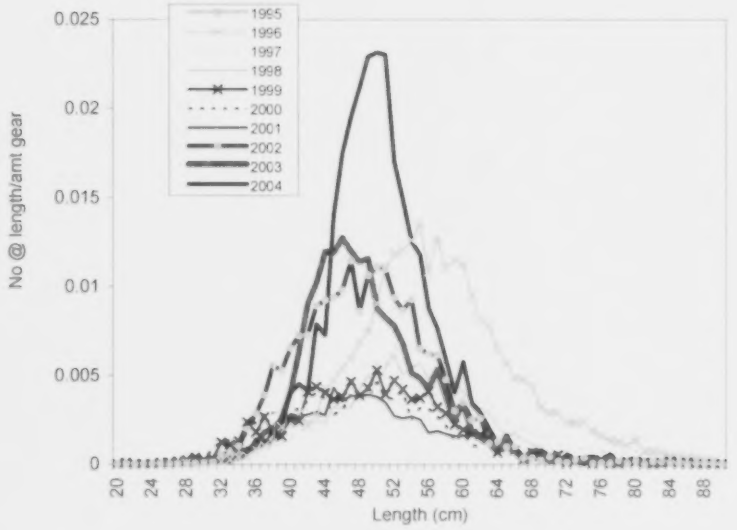
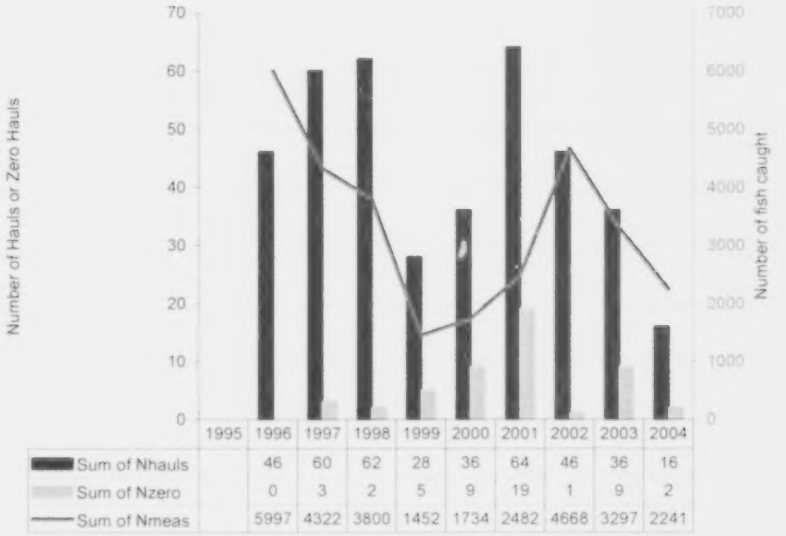


Figure 88. Relative length frequency (number at length / amount of gear) for control and experimental gears, Burgeo Linetrawl.



	1995	1996	1997	1998	1999	2000	2001	2002	2003	2004
Sum of Nhauls		46	60	62	28	36	64	46	36	16
Sum of Nzero		0	3	2	5	9	19	1	9	2
Sum of Nmeas		5997	4322	3800	1452	1734	2482	4668	3297	2241

Figure 89. Number of hauls (Nhauls), number of zero catch hauls (Nzero) and total number of fish caught (Nmeas), for control and experimental gears, Burgeo Linetrawl.

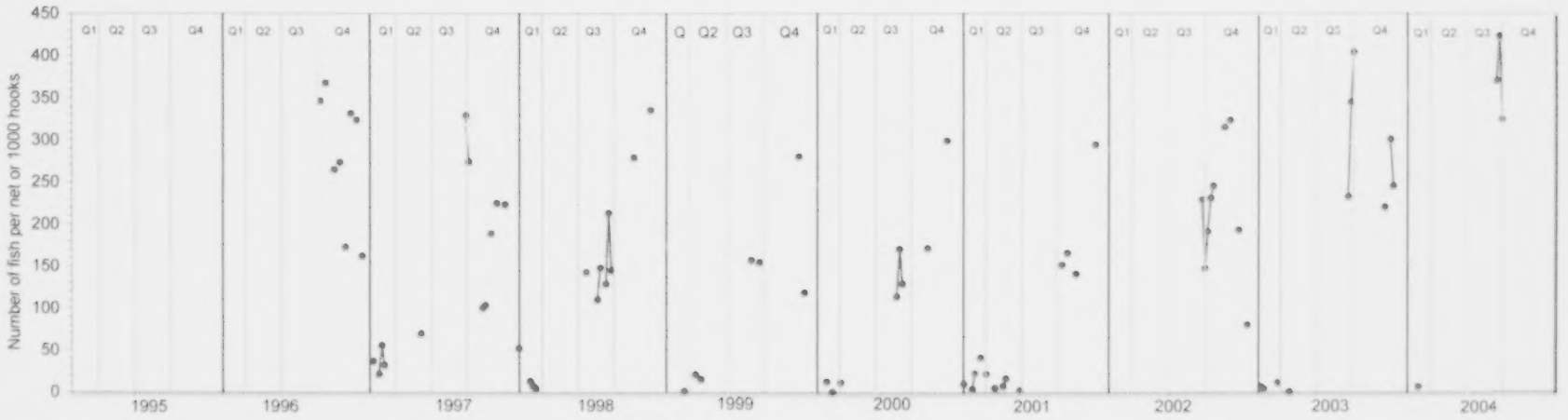


Figure 90. Catch per unit effort (in numbers of fish per 1000 hooks) for all sets (control and experimental) averaged for each week, Burgeo Linetrawl.